o. 1804 Vol. XLVII JUNE 21st, 1945

FLIGHT

and

AIRCRAFT ENGINEER

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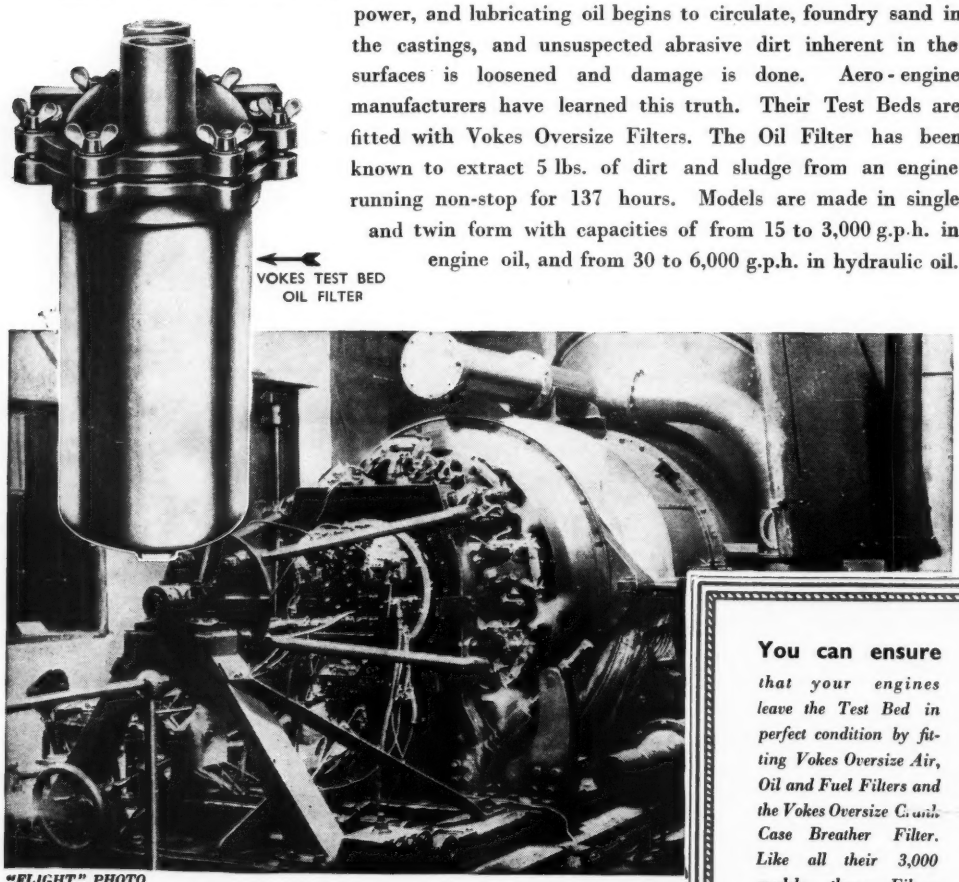
Engine wear
BEGINS ON THE TEST BED

IT is a well-known fact that the first few hours of an engine's "life" are the most critical. That is why manufacturers insist upon certain speed limits being observed if their guarantees are to remain valid. But only recently—and in still too few quarters—has it been realised that the life—and wear—of an engine begins, not in service, but on the Test Bed. No matter how careful the makers may be in degreasing, cleaning and polishing the component parts, once an engine starts running under its own power, and lubricating oil begins to circulate, foundry sand in the castings, and unsuspected abrasive dirt inherent in the surfaces is loosened and damage is done. Aero-engine manufacturers have learned this truth. Their Test Beds are fitted with Vokes Oversize Filters. The Oil Filter has been known to extract 5 lbs. of dirt and sludge from an engine running non-stop for 137 hours. Models are made in single and twin form with capacities of from 15 to 3,000 g.p.h. in engine oil, and from 30 to 6,000 g.p.h. in hydraulic oil.



VOKES TEST BED OIL FILTER

"FLIGHT" PHOTO

You can ensure

that your engines leave the Test Bed in perfect condition by fitting Vokes Oversize Air, Oil and Fuel Filters and the Vokes Oversize Crank Case Breather Filter. Like all their 3,000 models, these Filters have an efficiency rating of 99·9 per cent.; and 25 years of scientific manufacturing experience is behind their production.

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FLIGHT
and
AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

COVENTRY: 8-10, CORPORATION ST. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.
BIRMINGHAM, 2: GUILDHALL BUILDINGS, NAVIGATION ST. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).
MANCHESTER, 3: 260, DEANSGATE. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.
GLASGOW, C.2: 26B, RENFIELD ST. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

Registered at the G.P.O. as a Newspaper.

No. 1904. Vol. XLVII. June 21st, 1945 Thursdays, One Shilling.

The Outlook

Bomber Command's Offensive

IN reading the official account of the nightly air battles which went on over Germany and the Occupied Countries for five and a half years, there is one fact which stands out from the very remarkable background. It is clear that at every move, from the original conception of what should constitute a bomber force to the tactics of its employment, the R.A.F. was always well ahead of the German *Luftwaffe*.

That we were slow to build up our bomber force must be recognised as a fault lying at the door of the politicians. Whatever force was available at any particular time, our air chiefs used in the correct manner, "keeping their eyes on the ball" the whole time.

The Germans had no night fighter force at the outbreak of war, and had to convert the best of their bomber force to meet the ever-increasing impact of our night raids. We, on the other hand, had practically achieved the same rate of casualty in 1941 as the highest rate (12 per cent.) ever imposed upon us in 1944.

In all this, the use of radar for detection and navigation has played a big part, and it is profitable to read the radar article on pages 663 and 664 in conjunction with the Bomber Command history. By doing so the story becomes even more complete. It was the ever-greater concentration in time and space, which radar made possible, that enabled us to keep our casualties low.

In one respect the official account is somewhat misleading. The statement is made that Bomber Command never fought any pitched battles with the German Air Force. What is meant, of course, is that we never sent tightly packed formations of bombers and fighters over Germany to be attacked at one time by major enemy formations in the same manner as the Americans.

Nevertheless, if we sent, as we did on many occasions, say, 800 four-engined bombers, plus a number of bomber support aircraft, to attack a target deep in Germany, and the enemy employed, say, 500 night fighters to meet them, any aircrew member will agree that the result was very much a pitched battle.

Nearly 6,000 highly trained men would be involved in the air alone in such a raid, and if the ground defences, ground direction and maintenance are included in the picture, then each raid of this magnitude becomes the equivalent of an ordinary attack at army corps strength.

Co-operative Research

A PICTURE which we publish in this issue draws attention to an impressive achievement in that amazing country, the United States of America. Two new wind tunnels are nearing completion in which tests on aircraft models of up to 10ft. span can be made at speeds above the speed of sound and at densities ranging from ground level to the equivalent of 35,000ft

British technicians will instantly appreciate what the possession of two such wind tunnels will mean to the rate of progress of American aircraft design. In the new high-speed types now planned or nearing completion many problems are likely to arise out of the approach to what Air Commodore Banks in his recent lecture called the "compressibility wall." Theory indicates that there exist a possibility of getting through that "wall" and into better conditions on the other side of it, but the means whereby that may be achieved are far from being obvious.

The nation which first succeeds in solving some of these problems will have a long start over those which are still struggling with them. One way of shortening the process is obviously a wind tunnel in which the different factors can be examined under conditions which

approach as closely as possible to those obtaining in full-size aircraft at great speeds and heights. The new American tunnels permit of doing this. They are of the variable-density type, the pressures attainable ranging from as high as 60 pounds per square inch (four atmospheres) to four pounds per square inch. Thus airflow over models can be tested both for the equivalent of high full-scale speeds and for the rarefied conditions at great altitudes.

Five Million Dollars

WHAT makes the American achievement so interesting is not only the scale of the experimental equipment, which is in itself very impressive (each wind tunnel is costing something like two and a half million dollars), but the fact that it has been made possible by a very praiseworthy co-operative effort. The tunnel design, which is the same for both, was paid for jointly by the Curtiss-Wright Corporation and the California Institute of Technology. Curtiss-Wright paid for the building of their tunnel at Buffalo, while the expense of the other tunnel, at Pasadena, California, is shared by four west-coast firms—Consolidated-Vultee, Douglas, Lockheed and North American. The tunnel will be operated for these four firms by the California Institute of Technology. Thus America will have an east coast as well as a west coast tunnel of this latest type. These are, of course, additional to the large numbers of other tunnels of various type, private and Government-owned, which already exist in many parts of the United States.

There is in this new American achievement an example to follow and a warning to heed. When the Fedden training establishment was announced there were critical comments using expressions such as "grandiose" and "extravagant." Many do not appear to have gone beyond the period of the late 'twenties and early 'thirties in their views of what is necessary in modern times.

We do not, of course, suggest that the British aircraft industry could undertake a co-operative effort of a magnitude equal to the American, and in any case the Treasury would probably soon put a brake on any such "extravagance," but something *could* be done. Unless this country decides that research of this type is a good investment—taking the long view—British aircraft designers will have to be very clever or very lucky or both if they are not to be left behind in this new phase of aeronautical evolution upon which we have just entered. The trouble will be to convince those who hold the purse strings that we *are* on the threshold of discoveries with incalculable possibilities.

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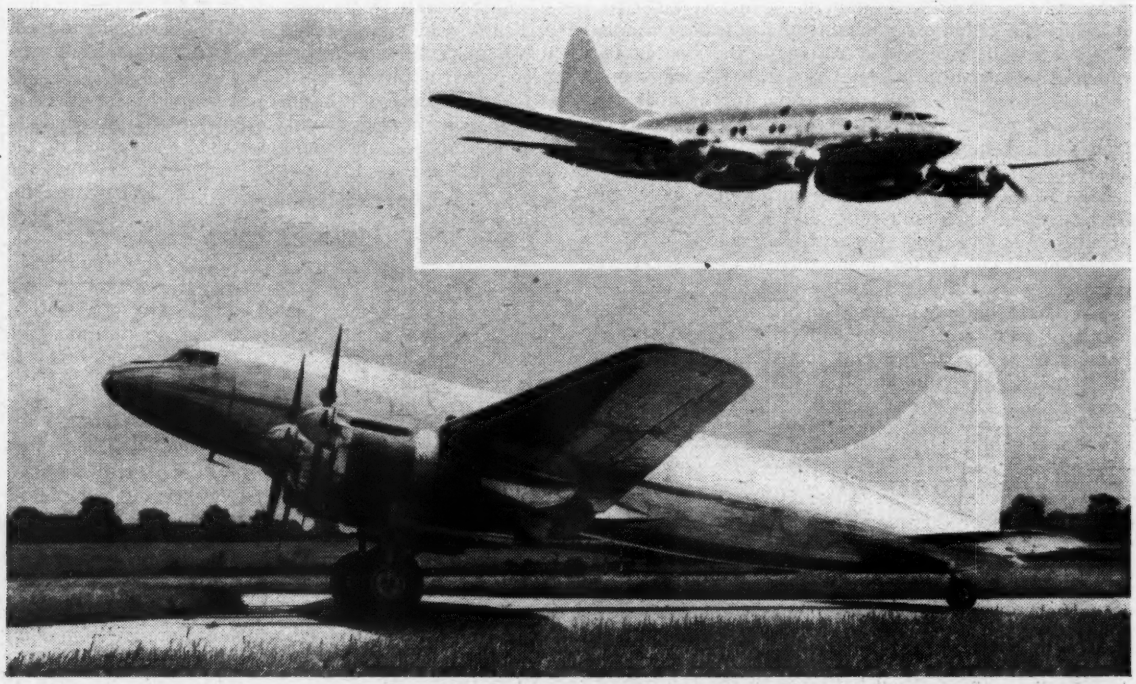
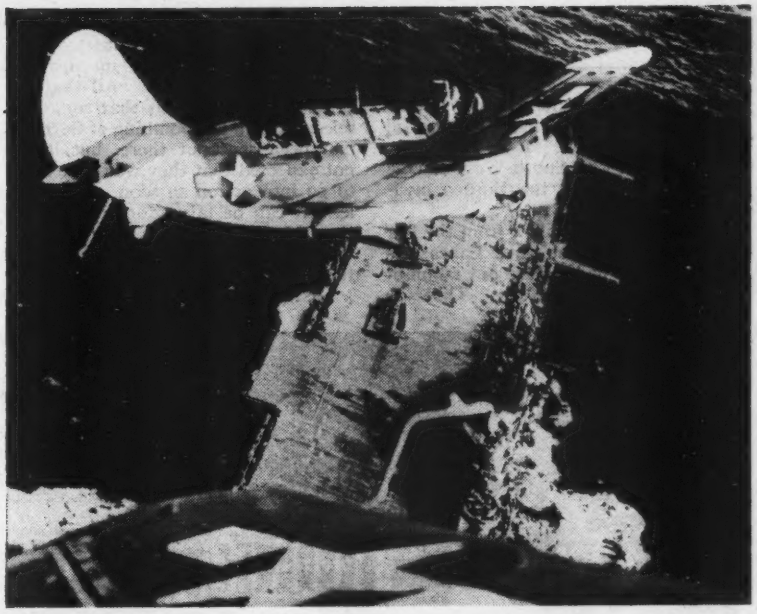


FIRST IN THE POST-WAR FIELD. The Avro Tudor I is the first of our new civil air liners to reach the flying stage. It is powered by four Rolls-Royce Merlins driving de Havilland constant-speed airscrews. Fully loaded it weighs 34 tons and has a disposable load of 38·5 per cent. of its all-up weight. Baggage and freight capacity is 3,730 lb. Total fuel tankage is 3,460 gallons, which gives an extreme range of 4,890 miles at 10,000ft., using an output of 500 h.p. from each Merlin. Further details appear on page 670.

WAR in the AIR

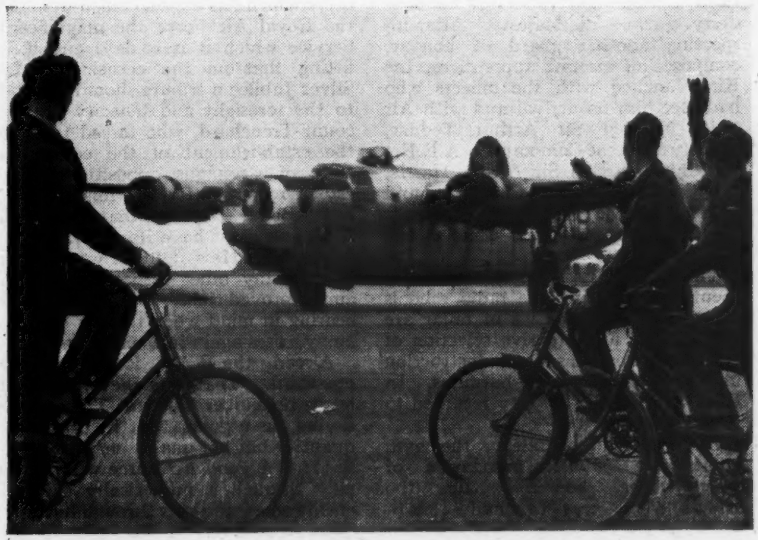
R.A.F. Transport Command Flies Troops to India : Invasion of Borneo



TO LAND-ON : A U.S. Navy Helldiver (S.B.2C) peels off from its formation to alight on the aircraft carrier below.

THE quickening of the tempo in the war against Japan was exemplified last week by news of the arrival in the Far East of the first military reinforcements to be flown out there from Britain. Initially the actual numbers involved are admittedly small, but they are to be steadily increased until their numbers run into many thousands every month.

R.A.F. Transport Command, of course, is being entrusted with this new and vital supply line between this country and Seac ; it entails a 6,000-miles flight which is completed in five days, allowing for a 48-hour rest in the Middle East to give the troops a certain amount of acclimatisation. From Britain they are flown to Lydda, in Palestine (it lies between Jerusalem and Jaffa on the coast), where they enjoy their two-day break, and are then flown on to Karachi, which one correspondent has romantically described as "The aerial St. Pancras" of that theatre of war. Just how much acclimatisation can be achieved within the short space of five days is, perhaps, a debatable point, but the brief rest at Lydda certainly breaks down the change in temperature from an English summer (especially the one enjoyed so far) and the Indian climate into two stages. Incidentally, the vast majority of the men, for whom this is the first taste of air travel, are all in favour of the swifter means of travel ; getting there in a few days instead of taking weeks makes them feel they are not so far away from their homes and families, with a very beneficial effect upon morale. It seems likely, too, that trooping by air between the home country and distant garrisons will prove no mere wartime expedient, but will be maintained in peacetime with very obvious advantages all round.



FOR FRESH FIELDS : Royal Air Force officers wave farewell to an 8th U.S.A.A.F. Liberator, leaving the Air Transport Command airfield at Valley, Wales, on its way to the Far East via Iceland and America.

Borneo Air Base

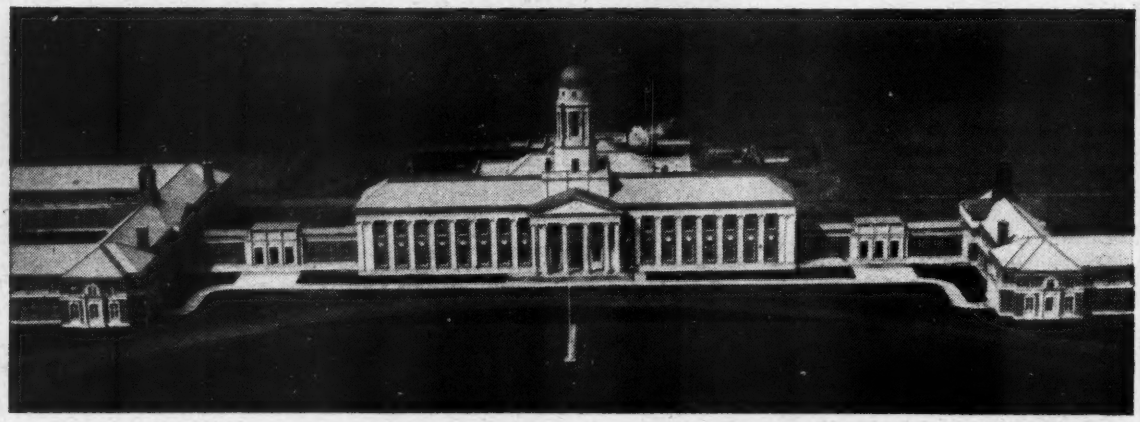
THE landings on North Borneo, the significance of which calls for no explanation (especially to the Japs) have gone extremely well, thanks in the first place to the very thorough preliminary bombardment by Australian and American ships and aircraft, whose co-ordinated efforts levelled the beach defences, after which aircraft covered the actual landings. One advantage to the attackers in such a vast theatre of operations as the Pacific presents is that the Japs never know just where the Allies will strike next, and so, once again, they were taken by surprise and our casualties were light. One of the early objectives gained was the airfield on the island of Labuan and the adjacent town. Lying at the entrance of Brunei Bay on the south side of which is Brunei itself, also taken, its capture virtually neutralised any local air defence the Japs might have tried to offer and at the same time gave the Allies an additional air base of extreme strategic value. A British-owned island of about 35 square miles, Labuan is also a coaling station and oil centre. The landing on the mainland was made at Brooketon, on Brunei Bluff and 16 miles from the capital ; Brooketon was devastated by the pre-invasion bombardment. The importance attached to these operations is, in fact, indi-

WAR IN THE AIR

cated by the statement of Mr. Drakeford, who said that the most powerful formations of the R.A.A.F. ever assembled in the South-West Pacific paved the way for the Borneo invasion.

Another big news item from the Far East last week was that Lancasters of the R.A.F. had carried out a bombing attack on Hong Kong. This was the first intimation that Britain's most celebrated (to date) heavy bomber was actually "on ops" in this part of the world. All that was previously known was that squadrons released from the bombing of Germany had been sent out there, but it was not expected that they would be ready to go into action so soon. Nevertheless, it can be taken for granted that the new Lincoln will soon take over, very largely, from the "Lanc" in the culminating assault on Japan.

Last week-end Superfortresses dropped 3,000 tons of fire bombs on four industrial centres in Japan; these towns were of secondary importance, implying that the primary war targets there need no further attention for the time being. Fighters of the U.S. 14th Air Force carried out a sweep over 2,000 miles of Jap communications from Indo-China to Inner Mongolia, inflicting heavy damage on railway targets for the loss of only one aircraft, and softening-up air attacks on the Amami Group, 150 miles north of Okinawa were also begun.



"Flight" photograph.

Cranwell's Jubilee

His Majesty Visits R.A.F. Cadet College for Its Silver Jubilee

THE postponed visit of His Majesty the King to Cranwell Cadet College, originally planned for May 16th but postponed on account of the many engagements arising out of the victory over Germany, took place on June 13th. The King flew there from Northolt, piloted by Sqn. Ldr. J. H. V. Millington, and was accompanied by Air Commodore E. H. Fielden, Captain of the King's Flight. A squadron of fighters of the R.A.F. escorted His Majesty.

Flying to Cranwell in other aircraft to meet the King were Mr. Harold Macmillan; Sir Louis Greig; Lord Templewood; Lord Beatty, Under-Secretary of State for Air in the Lords; Sir Charles Portal, Chief of the Air Staff; Air Marshal Sir Norman H. Bottomley, Deputy-Chief of the Air Staff; Air Marshal the Hon. Sir Ralph Cochrane, A.O.C.-in.C., Transport Command; Air Marshal Sir Roderic Hill, Member of the Air Council for Training, and Air Commodore F. J. Fressanges, commanding No. 47 Group, Transport Command.

In addition to those who flew to Cranwell for the occasion, the King was met by Marshal of the Royal Air Force Viscount Trenchard; Air Marshal Sir Arthur Barratt, A.O.C.-in C., Technical Training Command; Air Marshal Sir Philip Babington, A.O.C.-in-C., Flying Training Command; and the station commander, Air Commodore W. E. G. Bryant.

After inspecting a guard of honour of cadets, the King drove to the college, where two former Air Ministers, Lord Templewood and Lord Londonderry, greeted His Majesty. After inspecting another guard of honour, composed of aircraft apprentices, the King lunched with the officers who had met him on arrival and with Air Chief Marshal Sir Arthur Tedder, Deputy Supreme Commander, A.E.F.; Air Chief Marshal Sir Arthur Harris, A.O.C.-in-C., Bomber Command; and Marshal of the Royal Air Force Sir John Salmond, a former Chief of the Air Staff.

The rest of His Majesty's visit was spent in inspecting the radio schools at which the intricacies of radar are taught, and an extensive selection of "booby traps" used for instruction in how to render them harmless. In the afternoon His Majesty returned to Northolt by air.

Cranwell Cadet College, the 25th anniversary of the foundation of which was honoured by the King's visit, was originally established as an air station by the Royal Naval Air Service during the first World War. The first commandant of the College was Air Commodore C. A. H. Longcroft, who was assisted by Wing Cdr. Killner (O.C., R.A.F. Boys) and Wing Cdr. Rees, V.C. (who commanded the flying wing).

Cranwell has played an important part in establishing that *esprit de corps* which has done so much to make the Royal Air Force the magnificent Service which it is to-day, and it is fitting that on the occasion of its Silver Jubilee a tribute should be paid to the foresight and tenacity of Viscount Trenchard, who forced through the establishment of the college in spite of strenuous opposition. The cry in 1920 was for "retrenchment," but "Boom" insisted that the Royal Air Force must have its equivalent to Sandhurst. How right he was in this as in many other respects has been amply proved since. The fact is worth bearing in mind when the cry for economy arises again in the near future.

Already the R.A.F. is being cut by one-third. That was inevitable, but let us remember Viscount Trenchard's saying, in arguing that in peacetime quantity but not quality may be sacrificed: "A good Air Force will cut its way through a numerically superior enemy as a knife cuts through butter." That came true—convincingly—in the Battle of Britain, when "the few" beat the hordes of German aircraft which assailed us.

HERE AND THERE

First Flight Cover

A LETTER of greeting from Qantas Empire Airways, Ltd., has been received by *Flight* under the first flight cover of the recently inaugurated Lancastrian mail service from Australia to England.

"This new fast mail service, bridging half the earth in less than 80 hr.," says the letter, "marks yet another step forward in Empire Communications and forms a strong link between overseas Dominions and the Mother Country."

Post-war R.I.A.F.

INDIA, after the conclusion of the war with Japan, will maintain the Royal Indian Air Force with an initial strength of not fewer than ten squadrons, the Government of India announces.

The force will include, in addition to flying and servicing personnel, the necessary training and ancillary units required for full effectiveness and to ensure adequate scope for the careers of permanent personnel.

The Government announcement emphasises that this is only the initial and minimum strength, and will be expanded.

Credit to the Scientists

GENERAL SIR FREDERICK PILE, Director-General at the Ministry of Works, and former G.O.C., A.A. Defences, told Westminster Savings Committee recently that ninety-nine and a half per cent. of the credit for the A.A. success against enemy aircraft was due to the scientists.

They produced "instruments of such accuracy that they rivalled the human eye—of such speed that the speed of light was equalled."

So successful were the scientists it had been possible to withdraw Fighter Command's squadrons from the defence of London later on and to hand over the job to the guns.

The D.H. Goblin

BEING the first engine to pass the official type test in the new gas-turbine category, the de Havilland jet-propulsion unit, known as the Goblin, is the proud possessor of Certificate No. 1.

It powers the de Havilland jet fighter, the Vampire, which is reported to exceed 500 m.p.h. by a handsome margin—and over a wide altitude range throughout which it is believed to be the fastest aircraft in the world.

Production of their gas-turbine engines was taken over by the de Havilland Engine Co., Ltd., which was "budded-off" from the parent firm in January, 1944, and it is intended that this subsidiary enterprise shall also take over production of the Gipsy range of piston engines at the end of September next.

AT THE DOUBLE: Paratroopers at a base of the U.S. First Troop Carrier Command practice jumping from both sides of a Skymaster simultaneously. All jumping has hitherto been in a single stream from one side only.

Over-drive Top

"I SHOULD like to see this nation geared to at least 50,000 aircraft a year. Furthermore, I believe that this nation should plan a programme which will provide us with 50,000 military and naval aircraft."—Thus President Roosevelt in May, 1940.

To-day America is producing aircraft at the rate of 80,000 a year, and, moreover, they are better armed and armoured, and of appreciably greater structure weight than the 1940 types.

Farnborough's Fear

THE Government's proposal to transfer certain activities from the Royal Aircraft Establishment at Farnborough to the projected new research station at Bedford has alarmed the Farnborough Urban Council which fears it would seriously affect employment in their own and adjoining districts in Hampshire.

As a result, the Council has already made representations to Capt. Oliver Lyttelton, M.P. for the Aldershot Division, and is convening a conference of local authorities with the idea of taking joint action.

Prejudice Without Pride

IN an article in a recent issue of the Australian journal, *Wings*, entitled "So You Want to Fly for Fun?" the writer, Alred Heintz, goes out of his way to disparage the air-cooled, horizontally opposed type of engine fitted to the light (mostly high-wing) aircraft so popular with clubs and private pilots in the U.S.

Referring to them as "under-powered cabin jobs," he alleges that "the over-worked, overgrown motor cycle engines need too much maintenance."

In view of the splendid service given during the war by hundreds of such aircraft this strikes us as a totally unwarranted attack. British-built Austers, for example, certain marks of which employ this type of engine, have done yeoman service under very arduous conditions and with the simplest of open-air maintenance.

And *any* air-cooled engine could be dubbed "an overgrown motor cycle engine" if one is prepared to ignore accuracy for the sake of an easy sneer.

"Demobbed" Airmen

AIR COMDRE. E. L. HOWARD WILLIAMS, air correspondent of the *Daily Telegraph*, Independent parliamentary candidate for Cambridge University, and chairman of the executive committee of the R.A.F. Association, expressed concern about demobilisation plans when he spoke at Kensington recently.

He said that while they accepted the contention that the war with Japan must be won, they were nevertheless anxious that when airmen and airwomen were demobilised after the Japanese war they should not find all the best jobs gone.

Chronological Confusion

OWING to an error in transcription, two dates were wrong in the article on the Gipsy Major engine in last week's issue. The years of the first Gipsy and the first completion of 600 hours without overhaul were given as 1937 and 1938 respectively. They should, of course, have read 1927 and 1928 respectively, a fact which was fairly obvious from the context.

Bombers Into Bungalows

IN a list of Government factories recently allocated to various manufacturing concerns for post-war civilian production, issued by the Board of Trade, are included the Bristol Aeroplane Co., Vickers Armstrongs, and the Blackburn Aircraft Co., all of whom are to

HERE AND THERE

construct temporary houses. A picture of a Bristol house in course of assembly was given in these columns last week.

Bristols are taking over factories at Hucclecote and Weston-super-Mare, Vickers Armstrongs at Blackpool and Chester, and Blackburn at Dumbarton.

Morris Motors and the Austin Motor Co. are to produce cars at Castle Bromwich and Rednal respectively, while other allocations include those to Taylor, Taylor and Hobson (photographic lenses at Leicester), Alfred Herbert (machine tools at Lutterworth), and Smiths English Clocks (watches at Ystradgynlais, Wales).

Carrying On

FACTORIES built by the Government at Hillington (Scotland) and leased to Rolls-Royce for the production of Merlin engines, however, are to be continued by that company, Sir Stafford Cripps having stated in an interview with a *Flight* correspondent in Glasgow that it was essential for Scotland to have a first-class aircraft engine and motor industry.

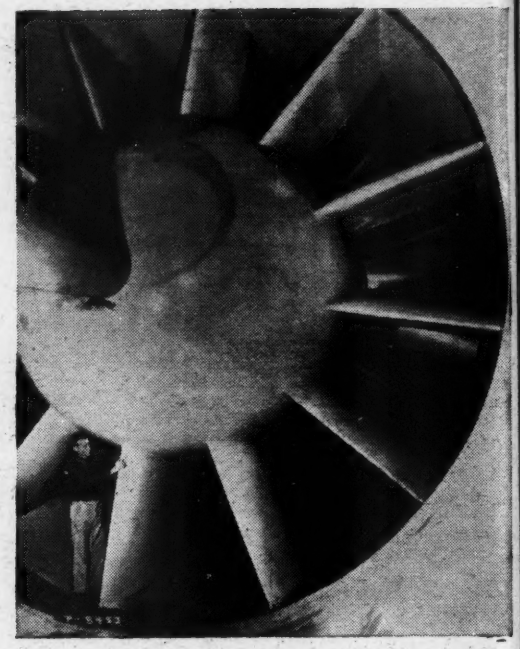
Precise plans for these factories have not yet been announced by Rolls-Royce at the time of writing, but it is reported that they will include experiments with new and still higher-powered versions of the Merlin, and the development of jet-propulsion units.

Ernst Udet's Death

READERS will remember that when the death of Ernst Udet, the famous German air "ace" of the 1914-18 war, was reported in the autumn of 1943, it was given out by the Nazi propaganda news that he had been killed in a flying accident while testing a new type of aircraft.

It has now been learned from Berchtesgaden, according to New York Radio quoted by Reuter, that he shot himself because he failed in attempts to develop a new high-altitude aircraft.

Hans Jeschonek, the reports added, also committed suicide to anticipate "liquidation" by Hitler for having failed to save the Peenemunde experimental station from the attentions of the R.A.F. It is difficult to imagine how he could have done so.



GALE-MAKER at the business end of the giant wind-tunnel at the California Institute of Technology, capable of producing a 700 m.p.h. breeze. The test chamber measures 8ft. 6in. by 12ft. Behind the fixed rectifying vanes can be seen the contra-rotating fans.

News in Brief

Lt. Gen. John Cannon, Allied Air Commander in the Mediterranean, has been presented with the Oak Leaf Cluster to the Distinguished Service Medal (U.S.) by Gen. Joseph P. McNarney, Field Marshal Alexander's deputy.

* * *

The honorary degree of Doctor of Science has been bestowed by Omaha University on Glenn L. Martin, president of the aircraft company bearing his name. This is only the third time in its history that this university has presented an honorary degree.

* * *

Eighty officers of the "Waves"—the U.S. equivalent of the "Wrens"—have been trained as navigators and are to fly with regular Navy aircraft operating between the U.S. and such places as Hawaii and the Aleutians. They will be the first women in the U.S. Forces to go on active service.

* * *

Rear-Admiral D. J. Hoare has been appointed director of research by the Council of the British Internal Combustion Engine Research Association with the consent of the Admiralty. Adml. Hoare is at present superintendent of the Admiralty Engineering Laboratory, but expects to take up his new duties on July 23rd next.

* * *

The War Assets Corporation, formed by the Canadian Government, has sold £447,618 worth of surplus aircraft. Types include Tiger Moth, Cornell, Anson, Cessna Crane, Stinson 105, Oxford V, Lockheed, Grumman Goose, and even a Canadian-built Stranraer. Canadian civilian operators bought 62 aircraft, and 276 went to various places in North and South America.

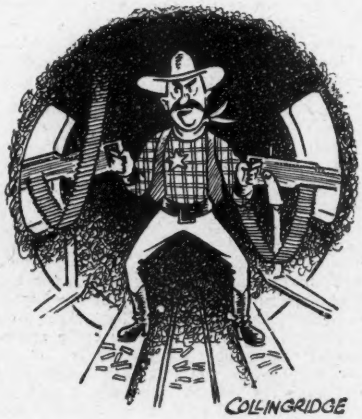
Recent reports say that the new giant flying-boat to be developed by Howard Hughes will have eight engines, a span of more than 300ft., a hull length of 220ft., and will be constructed of laminated wood. It is claimed that it will be able to carry 750 fully equipped troops.

* * *

The fuel tanks in the Miles Aerovan described in our issue of June 7th were manufactured by Fireproof Tanks and are not Henderson crash-proof tanks, as we stated. Large numbers of Henderson Safety Tanks have been fitted in Miles Masters.

* * *

The British Legion reports in its news bulletin that over 1,000 letters a day on vital matters affecting serving and ex-service men and women are now being dealt with at its Richmond headquarters, where the postal bill has risen from an average of £110 monthly to £300 per month.



* * *

An exhibition of novel products, many of which have only recently been released from the secret list, produced by thirty-five Dunlop factories in Britain and the Empire, is to be opened at the Royal Empire Society, Northumberland Avenue, London, on July 2nd by Sir George Beharrell.

* * *

The growth of the filtration industry during the war, when its products played a vital part in prolonging the life of British equipment, has led to the proposal to form a Society of Associated British Filter Manufacturers, the inaugural meeting of which is to be held at the offices of Messrs. Peat, Marwick, Mitchell and Co., 94-98, Petty France, Westminster, at 2.30 p.m. on Friday, July 6th.

* * *

The final round in the contest for tailless model aircraft being held by the S.M.A.E., for which Sir Frederick Handley Page is giving £100 in prizes as mentioned in *Flight*, May 10th, is to take place on September 2nd on the Handley Page airfield at Radlett, Herts. There are five £10 area contest prizes and a £50 prize for the winning finalist.

* * *

Eighty-five per cent. of the current U.S. tyre production for military lorries and aircraft is of synthetic rubber; and at least half the 29,000,000 passengers' motor cars in the U.S. run on the same material, according to a recent statement by Mr. James J. Newman, the Goodrich vice-president.

AUSTRALIAN-BUILT

The Beaufighter in the foreground has Wright engines. It was re-designed and built by the Beaufort Division as an insurance against engine shortage.

An Account of the Good Work Done by Australian-built Aircraft Types in the Pacific War

By JOHN STOREY

Director of Beaufort, Beaufighter and Lancaster Production in Australia

THE author, as director of the Beaufort Division of the Department of Aircraft Production in Australia, has seen, and taken a leading part in, the growth of output in the aircraft factories of the Commonwealth. This aspect he deals with in an article in our associated journal Aircraft Production. *Here he gives an illuminating picture of the conditions under which Australian crews work and a glimpse of the many great achievements of the Royal Australian Air Force.*

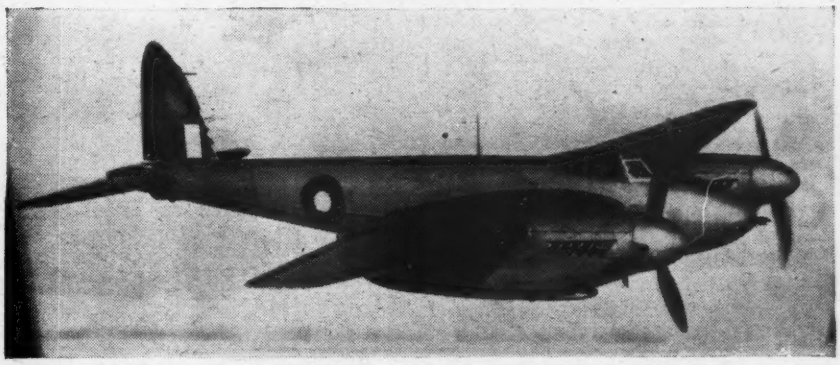
HAD Australia's aircraft industry been fully developed four years earlier, the whole course of the war in the Pacific might have been changed, and this in turn would have had a profound effect on events in Europe. It was not till the latter half of 1939 that the Commonwealth embarked on the production of a front-line aircraft—the Beaufort torpedo bomber. The first seven Australian-built Beauforts were sent hurriedly to Singapore when Japan invaded Malaya in January, 1942, but it was the old story of "too little and too late." If 500 Beauforts had been available, what a different story it might have been, but it was not till November, 1943, that the 500th Beaufort rolled off the assembly line.

Air War in the Pacific

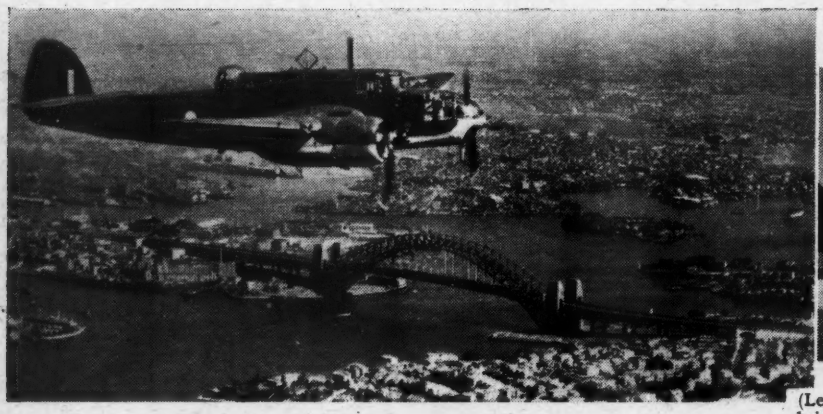
Emphasis has since been laid on the lesson thus learned by the splendid service rendered to the Allied Cause in the Pacific by Australian-built aircraft. The lion's share of the work has been done by Australian-built Beauforts, which have performed a wider variety of functions than any other type of aircraft employed in the Pacific area: as torpedo carriers attacking enemy shipping; in bombing raids on important enemy bases such as Rabaul, Gasmata, Kavieng, Buin, Faisi, Paronga, Wewak and Timor; in Army and Navy co-operation work; and on long-range reconnaissance over sea and land. Beauforts have also patrolled Australia's 12,000 miles of coastline and convoyed Allied ships carrying many millions of pounds' worth of munitions and supplies and hundreds of thousands of Allied troops.

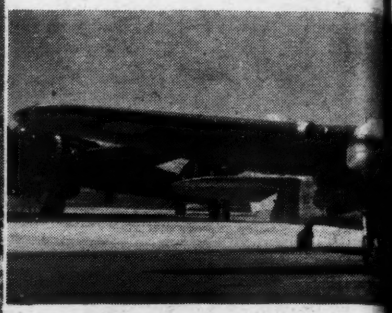
This work has been ably supplemented by the operations of other Australian-built aircraft, notably the Beaufighter, the Boomerang and the Wirraway, whilst more recently the Australian-built Mosquito has gone into action. Moreover, Australian-built Tiger Moths, Wackett Trainers and Wirraways have proved invaluable for preliminary training.

Air warfare in the Pacific differs radically from that in the Northern Hemisphere, not only because of climatic conditions, but also because R.A.A.F. squadrons must frequently operate from makeshift airfields which are little more than tiny strips cut



The first Mosquito built by the de Havilland Co. Pty. Ltd., in Australia. Many of these are now in operation with R.A.A.F.





(Left) The last of the Australian produced Beaufo... bridge. (Centre) A transport aircraft develo... 5 passengers and has 30 cu. ft. of cargo sp... flying over the Shrine of Remembrance erected...

out of dense jungle. Owing to shipping shortages, the problem of maintenance and servicing and of supply generally in areas thousands of miles away from the manufacturing centres is one of great difficulty and complexity.

The R.A.F. pilot engaged in missions over Europe set out from a well-equipped air base and returned to it when his mission was over. He had a comfortable bed, passable food, the fellowship of both Air Force confrères and civilian friends. He had at his disposal the most efficient and up-to-date equipment to keep his craft in a serviceable condition, and had frequent opportunities of meeting those near and dear to him.

The R.A.A.F. pilot in the Pacific, on the other hand, is thousands of miles away from civilisation. He lives under conditions of sweltering tropic heat, subject to malaria and other dread tropic diseases; he operates in torrential tropic downpours and fierce tropic storms, and for a great part of the time his station is little more than a quagmire, whilst his contacts with the outside world are few and far between. Further, whereas an R.A.F. crew usually bombs easily recognisable targets, such as large centres of industrial activity, the R.A.A.F. air crew is required to attack much smaller and more isolated targets, often involving return journeys up to 1,000 miles over sea and over rugged mountains, ranging up to 15,000ft. in height. Crews operating in the Pacific have not been subjected to the same intensity of ground or fighter defence, but the tropic conditions make the hazards just as great, though they are of a different character.

Australian Aircraft in Action

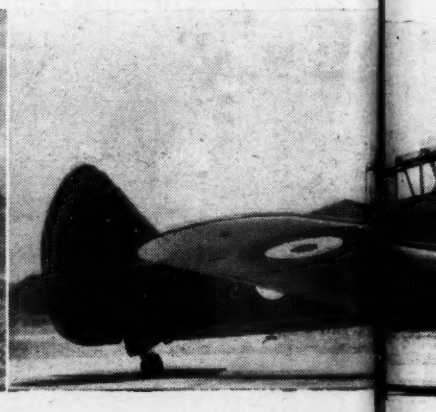
The first Beaufort squadron had its baptism of fire near Lae in New Guinea in June, 1942, in the early days of the Japanese occupation, when a Japanese supply ship, the *Tenyo Maru*, was sunk by a Beaufort bomb. This was followed by the sinking of another Japanese merchantman at Milne Bay, and shortly afterwards the same squadron delivered a smashing attack on a Japanese naval squadron off Gasmata, in which one cruiser was certainly destroyed and other cruisers and destroyers damaged. Early in September, 1942, Australian Beauforts, in a series of Allied attacks on Japanese warships north of Milne Bay in Papua, damaged a cruiser and destroyer with bombs and torpedoes. This occurred at the turning point of the Pacific war, just before Australian military forces scored the first Allied victory of the war against the Japanese by routing a powerful force at Milne Bay on September 5, 1942.

The tale of successes continued throughout October, with Beauforts scattering a large Japanese naval force off the North-West Solomons, when three light cruisers and two medium-sized merchant ships, anchored between Faisi Island and Buin at the top of Bougainville Island, were believed to have been hit by torpedoes dropped at close range. On March 5, 1943, Australian Beaufort squadrons had participated in the Bismarck Sea Battle, when Allied aircraft accounted for every ship in a Japanese convoy of 22 warships and transports. Again in June, 1943, we find a record of a direct torpedo hit on a Japanese light cruiser, which was undoubtedly sunk outside Gasmata Harbour.

Heroic Beaufort Pilots

Then there is the epic story of the lone Beaufort, piloted by Pilot-Officer W. Barr, which fought six Zeros off New Britain, destroying one, damaging three others and driving off the remaining two. This was but one of a series of incidents in which Beauforts survived attacks by groups

(Below) The 175 h.p. Warner Super Scarab engined Wackett trainer which was designed and produced in Australia. Some 200 were built.



BUILT

...ying over the famous Sydney Harbour ...om the original Bristol Beaufort. It carries (Right) An Australian Beaufighter Mk XXI Melbourne as a memorial of the 1914-18 war.

of from three to six single-seater Japanese fighter aircraft. Another chapter as yet unwritten tells of the ceaseless, hard, slogging, arduous fight against enemy submarines. The full record of the successes achieved by these relentless anti-submarine patrols has not been disclosed, but we do know that in a single week lone Beauforts sank two submarines in the Coral Sea, whilst in other areas further kills were recorded.

When the enemy's main base in the South Pacific was Rabaul, the Beaufort Squadrons "adopted" that stronghold as their own particular rendezvous, making daily and nightly attacks over a period of months in the face of heavy opposition from the air and from ground defences. These smashing attacks on Rabaul and the huge accumulations of Japanese shipping congregated there to protect and supply the land forces, constituted one of the greatest contributions made by any section of the Allied Air Forces to the destruction of enemy bases.

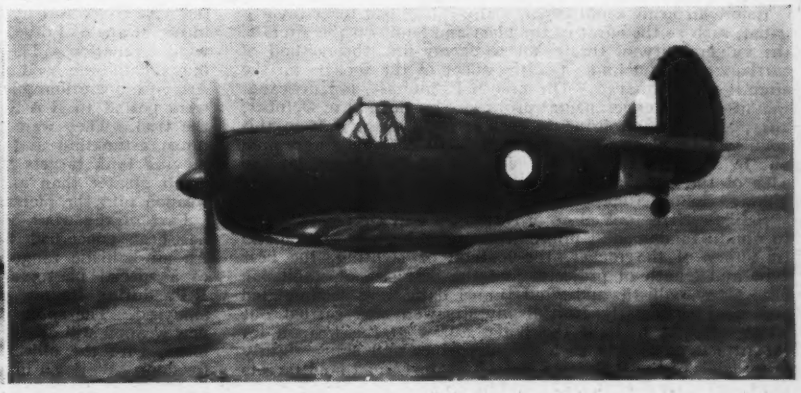
Typical of the great exploits which characterised this series of attacks on Rabaul is the story of Sqn. Ldr. Owen Price, who took part in a devastating attack on Rabaul on the night of October 8, 1943. While portion of the force bombed a near-by airfield, Owen Price and other Beaufort torpedo bomber pilots attacked a concentration of eight cruisers, 14 destroyers and 12 merchant ships lying in Simpson Harbour. As the torpedo bombers reached the Harbour, it became alive with anti-aircraft fire and blinding searchlights. Price launched his attack with great coolness and daring in the face of an intense barrage, and torpedoed a 7,000-ton vessel lying in front of the warships. He was lifting his plane to fly out to the north-east when it was shot down into the Harbour. This was recognised as being one of the most gallant attacks made by any airman in the Pacific, and, although it did not receive recognition through any posthumous award, yet is will live in the annals of the R.A.A.F., and will serve as an inspiration to Australian airmen for all time to come.

Beaufighters Join the Fray

Attacks on Rabaul continued right up till November, 1944, when Beaufort squadrons moved farther north to co-operate with the A.I.F. in cleaning the Japanese out of the areas around Aitape in New Guinea. In the meantime they had been joined by squadrons flying English Beaufighters, which were gradually supplanted by Australian-built aircraft of the same type. These Beaufighters ranged up and down the northern coast of New Guinea, wreaking havoc on Japanese shipping and communication lines. The Beaufighter bases gradually moved northward to Noemfoor, and on to Morotai in the Halmaheras, from which they flew out to attack the enemy in the Celebes, the Philippines and Borneo.

Beauforts and Beaufighters also participated in the attacks on Timor and the surrounding islands. Wherever they have served they have gained for themselves an enviable reputation, not only as effective combat aircraft, but

(Centre) Another Australian design is the Wirraway Advanced Trainer which is powered by an Australian built 650 h.p. Pratt and Whitney engine. (Right) A medium interceptor and Army co-operation type—the Boomerang—which was developed from the Wirraway.



AUSTRALIAN-BUILT

The 1,000th D.H. Tiger Moth built in Australia. The majority of the R.A.A.F aircrews received their early training on these.

also for versatility, reliability and serviceability. Whilst this is a tribute to the skill of the R.A.A.F. aircrews and ground crews, a large measure of the credit must go to the excellent craftsmanship of Australian men and women who built these fine British-type aircraft. Moreover, the Beaufort Division of the Department of Aircraft Production has adopted the policy of attaching experienced field service representatives to every Beaufort or Beaufighter squadron, and has also paid very special attention to organising the supply of spares.

Evidence of the effectiveness of Australian-built aircraft is supplied by the fact that one Australian Beaufort completed 145 operational strikes and another 139 strikes before undergoing the 240-hour inspection, whilst many others have made 100 or more strikes. Looking down a list of pilots, we find men who have made 124 operational sorties in Beauforts, 113, 110, 107, and so on, furnishing striking illustrations of the reliability of these aircraft. One Australian Beaufort wing flew 2,000 sorties over New Britain in six months, covering 1,500,000 operational miles and dropping 2,000,000 lb. of bombs for an overall loss of only 0.7 per cent.

But the exploits of Australian-built aircraft were not by any means confined to Beauforts and Beaufighters, as the Wirraway, built by the Commonwealth Aircraft Corporation Pty., Ltd., has been in action since the first Japanese attack on Rabaul in January, 1942. On that occasion, gallant R.A.A.F. airmen in Wirraways vainly endeavoured to divert from their target a force of 120 Japanese aircraft acknowledged to be amongst the world's best fighter aircraft. It was an epic fight against hopeless odds. Since then Wirraway squadrons have served with distinction in New Guinea, New Britain and the Solomons, adopting the role of dive bombers, operating as pathfinders for other types of aircraft, attacking enemy land bases and shipping, and acting as the "eyes" of the Army and Navy on co-operation work. They played a big part in covering the land forces at Lae in September, 1943, and at Buna and Gona, where one Wirraway pilot, Flying Officer J. S. Archer, had the distinction of shooting down a Zero. More recently they have operated extensively and effectively with N.Z.R.A.F. aircraft in support of the A.I.F. on Bougainville Island.

The Wirraway's younger brother, the Boomerang, an Australian-designed medium interceptor of great manœuvrability, the first of which flew in July, 1943, has also been in the forefront of the fighting in New Guinea during the last 2½ years. These fine aircraft, designed and produced by the Commonwealth Aircraft Corporation, have proved particularly adapted to Army co-operation work in the precipitous valleys of New Guinea. They performed especially good work in the Ramu Valley and around Wewak, spotting for the Army, bombing and strafing and even acting as "biscuit bombers," dropping supplies to isolated patrols. Their record in New Guinea has been duplicated by their service in co-operation with the A.I.F. and N.Z.R.A.F. in recent operations in the Solomons.

The work done by Australian aircraft has worthily supplemented the fine achievements of the Australian Military Forces, which carried out the major part of the land operations in New Guinea.

ROCKET PROJECTILE DEVELOPMENT

THE original proposal for the development of a rocket-propelled anti-tank weapon was put forward in September, 1941, and since that date the R.A.E. has been actively engaged upon the development of the rocket. The aircraft weapons then available for the attack of tanks were bombs and cannon. The latter, even in the 40 mm. calibre, appeared likely to be outmatched by increased and improved armouring. Rocket motors, originally designed for anti-aircraft use, were immediately available and to these it was proposed to fit armour-piercing heads similar to those in use with the 25 pdr. gun.

Before air firing could begin, many things had to be investigated, such as the effect of the blast and flame on the aircraft, the vulnerability of the rocket to enemy fire, the method of carriage and launching, and the effect of the rockets on the aircraft's performance. The first R.P. aircraft, a Hurricane, was fitted with experimental projectors by the end of October, 1941, and the first firing of rockets from an aircraft in this country took place on October 25th, 1941. Rounds were fired out to sea with the aircraft picketed on the ground at the edge of the airfield. This was satisfactory and flying trials followed immediately.

Ballistic trials took place in November and December, 1941, to obtain fundamental information regarding the scatter and trajectory of the rocket, the method of sighting, the best type and length of projector and the best size of stabilising fin. Many ballistic and wind tunnel data were accumulated and one particularly fruitful investigation was carried out which brought to light the potentialities of the weapon for the attack of targets such as submarines and ships. Early firing trials of the R.P. from aircraft against small land targets gave somewhat disappointing results on account of inaccuracy. Normal methods employed by the fixed-gun fighter pilot were unsuitable for the new weapon.

At about this time the U-boat menace was beginning to assume serious proportions and attention was therefore turned to a fuller consideration of the possibilities of the R.P. as a counter to this danger. Coastal Command aircraft equipped with R.P.s went into operation early in 1943.

Attention was again directed to the attack of the smaller land target. The R.P. with its low "muzzle velocity" (it is only a small fraction of that of a cannon shell), its drooping trajectory and its comparatively long time of flight, is very sensitive to aircraft flying errors, e.g., incorrect aircraft speed, incorrect angle of dive, side slip and pilot's errors in range and wind estimation. The need for specialised training for R.P. pilots had been well illustrated in September, 1942. Three Army-Co-operation pilots, who had never before fired R.P.s, were posted to R.A.E. for three weeks prior to the date of the trial. They were given intensive training in low flying, range estimation and sighting. In the actual trial against moving tank targets the number of hits (25 per cent.) was much greater than anticipated and again brought the R.P. weapon into the picture as an anti-tank weapon.

Part of the work carried out on the R.P. at the R.A.E. has been concerned with the air ballistics of the weapon. An air ballistic range has been set up at which, by means of a special photographic technique, the behaviour of the R.P. during its air path can be accurately recorded and analysed. The special sighting problems associated with this new weapon still are the subject of much research and development, with the object of allowing the pilot greater tactical freedom. Work on improved design of head, motor, projector and sight is being actively pursued.

Radar

Partial Release of Some Systems Used by R.A.F. in Defeating the Enemy by Defence, and Fighter and Bombing Attacks

CO-ORDINATION of Anglo-American censorship seems to be at an unfortunately low level in comparison with the co-operation existing in other spheres of activity. We state this in view of the release in America of information on Britain's Radar resources whilst the subject is still shrouded in official secrecy in this country. However, as the disclosure was made available to all the world, we, too, publish the information while awaiting the official release.

Radar is a generic term covering all forms of radio-electronic identification and orientation systems. Of these there are a considerable number, many of which are still undisclosable although the basic principle of operation is common to all, and the description of how one device or system operates can be taken as a basis for all others. Briefly, radar can be said to be the application of basic radio principles to the general problems of determining distance in three dimensions of an object which will reflect radio frequency energy relative to an exploring station. The fundamental principles involved are the constant known speed of radio wave propagation and the reflective or echo principle which is a major characteristic of the ultra-high frequencies.

Two Systems

Without going too deeply into the individual systems, there are two major methods of radar detection which have been employed, either separately or in conjunction with each other. First is the system based on Doppler effect whereby exploring radio frequency energy, continuously transmitted, impinges on the target object whence part of the energy is reflected and its apparent frequency changed. The receiving equipment of the exploring station measures the difference in frequency between the transmitted and reflected waves in order to determine the speed of the object. Owing to the small changes in frequency, this method is most useful where fast moving target objects are involved.

The second system is based on pulse modulation of the exploring wave emanations, and the determination of the reflected impulses against a time scale. Radio frequency energy is modulated for pulsation intervals of from 1 to 50 microseconds (μ sec.) and the pulse ends before the reflected energy returns to the receiver, so that an indicating time scale set against the "blips" shown on the cathode-ray tube screen will determine the distance of the object.

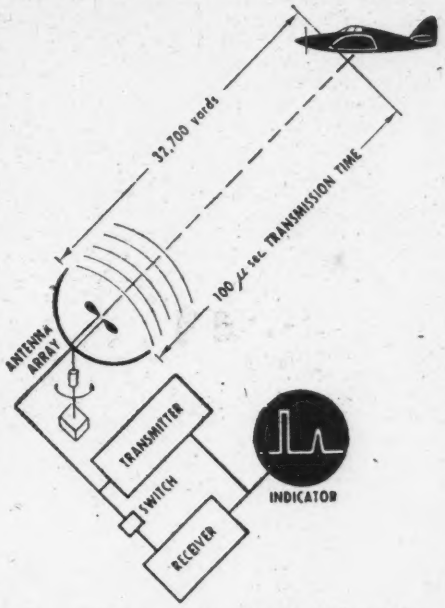
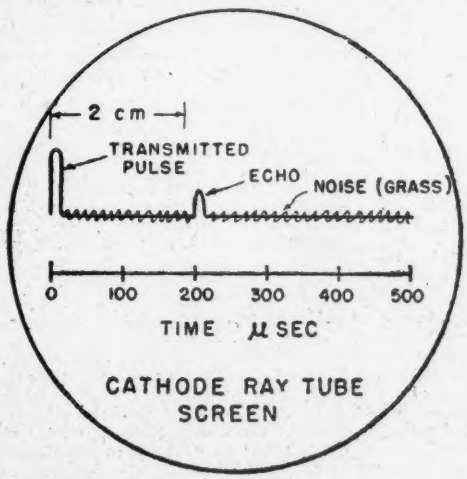


Fig. 1. Diagram of basic radar system showing direction "sighting" and transmission-reception time for range.

Time Datum

A fundamental quality in radar is the ability to convert time interval into distance due to the fact that radio energy radiated into space travels at a constant velocity, and that on striking an object is re-radiated in part with no loss of time. The velocity is that of light, which is 186,000 miles/sec., or 327 yards/microsecond. Referring to Fig. 1, if a 1 μ.sec. pulse is transmitted, the time taken for the pulsation to reach the objective 32,700 yards away would be 100 μ.sec, and as the reflection will require the same time to get back to the receiver the total time from transmission to reception will be 200 μ.sec. Since the indicator registers total elapsed time it is usual to calibrate distances (transmitter to object) as 164 yds./μ.sec between the initial and reflected pulsations.

In Fig. 2 is shown a diagrammatic illustration of the cathode-ray screen, across which the exploring wave and reflective pulsations sweep, and upon which the time and distance scales are graduated electronically. Initial and any reflected signals will appear on the screen as vertical "spikes." We will assume that the linear sweep of the wave pulse is 1 centimetre per 100 μ.sec., and that a pulse of 1 μ.sec. duration is being transmitted. This pulse will be 0.01 cm. wide on the screen, and during this time the exploring wave will have travelled 327 yards from the transmitter. Assuming that the target object is 32,700



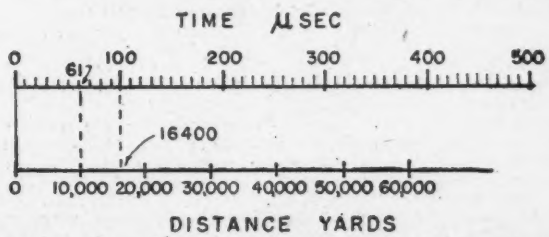


Fig. 2. Initial and reflection "spikes" shown on the C.R. screen can be read against a time-distance scale for determining range. The diagrams are reproduced from Electronic Industries, N.Y.

RADAR

yards distant, the pulse will arrive at the target in the time that the wave sweep across the screen moves 1 centimetre; further, the waves will move an additional 1 cm. before the reflected signal is received back, so that the interval between the initial and reflected "spikes" appearing will be 2 cm., corresponding to 200 μ.sec., and this interval read against the time-distance scales will show the object's distance from the exploring station to be 32,700 yards.

Orientation in elevation and azimuth, or altitude and bearing, is a simple extension of "tuning." The exploring wave emanates from a transmitter capable of being "sighted" until the maximum receiving strength is attained. Once this is determined the bearing in azimuth can be read relatively to true north or any other convenient datum similarly to a sighting compass. Again, when the transmitter is elevated to obtain maximum reflective reception, the angle of elevation θ can be resolved in conjunction with the known range of the object to give altitude by the simple equation: altitude = range × sine θ. A further method of determining orientation of the target makes use of a graticule on the cathode-ray screen (Fig. 3) upon which intersections of co-ordinate wave pulsation produce bright spots whose position is then read off against range and azimuth scales.

In Operation

So far we have said nothing about the romance of the use of radar nor of the "blood and sweat" efforts made to get it in operation in time for our meeting the enemy's attacks. Nevertheless, this story is a great and magnificent epic of British technical achievement and the foundation of our air power operations in, literally, all its forms. Without radar the Battle of Britain might never have had the chance to be fought; the bombing of Germany never accomplished; the sinking of U-boats by aircraft never achieved. Truthfully and without "window dressing" radar can be said to be one of the greatest scientific achievements of all time.

For the instigation and development of radar, and for the courageous conviction of its use, this country's indebtedness must primarily go to two men—Sir Robert Watson-Watt and Air Chief Marshal Lord Dowding. To the former is due the respect for secretly and quietly working for many years to overcome the enormous problems involved in perfecting the system after having conceived it. To the latter is due the homage for having dared to stake his country's existence on a revolutionary concept of warfare. These men should never be forgotten.

Primarily, our use of fighter aircraft for defence was dependent upon their control by G.C.I. stations (Ground Control of Interception), where the relative positions of our own and enemy aircraft was registered by radar. Knowing the positions by the indications on the screens, the controllers could direct our fighters by radio telephony to exploit any advantage of position, or to make the most

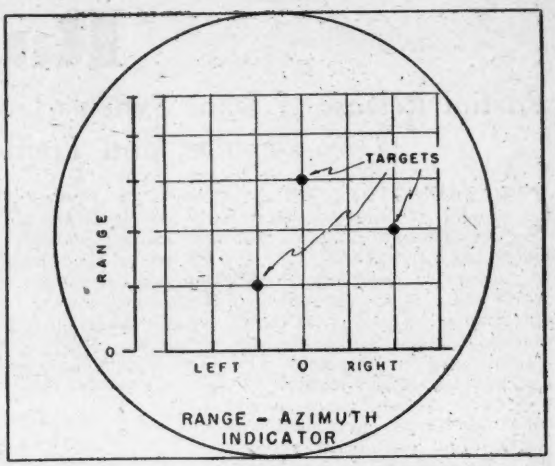


Fig. 3. Screen graticule on which target indications appear giving their position as co-ordinates of bearing and range.

rapid interception. In this manner a second-by-second portrayal of manœuvres was registered at the G.C.I. stations, and although the attacking aircraft might change course, the fighters could be re-directed accordingly absolutely immediately. The Few could not have prevailed without this operational government.

Later on came airborne interception equipment (A.I.), which comprised a radar set in the aircraft by means of which the target objective could be registered, stalked and attacked. A.I. sets were the reason why our night fighters scored such overwhelming victories against the *Luftwaffe* night raids and resulted in their being discontinued.

These are but two applications of radar. There are the devices by which aircraft identification could be made friend from foe; there are also the P.P.I. (plan position indicator) sets by means of which bombing or navigation through cloud and at night can be achieved with a precision far in excess of that possible with direct visual methods even under optimum conditions. Again, there is the equipment whereby our aircraft have been able virtually to scour the enemy ships and U-boats from the seas.

In reflecting over this wonderful story one should not pass over the radio manufacturing concern of Pye, Ltd., to which very great credit should go for the development and manufacture of the G.C.I., the A.I., and the P.P.I., in conjunction with the Government research establishment at Bawdsey under the control of Sir Robert Watson-Watt, and in conjunction with Professor J. D. Cockcroft, of St. John's College, Cambridge. However, in paying this tribute it must be pointed out that whilst Pye, Ltd., developed the G.C.I. and A.I. equipment, the leading British television manufacturers were also engaged in the development of radiolocation devices of which there are some hundreds of types.

NEW AIRCRAFT TYPES

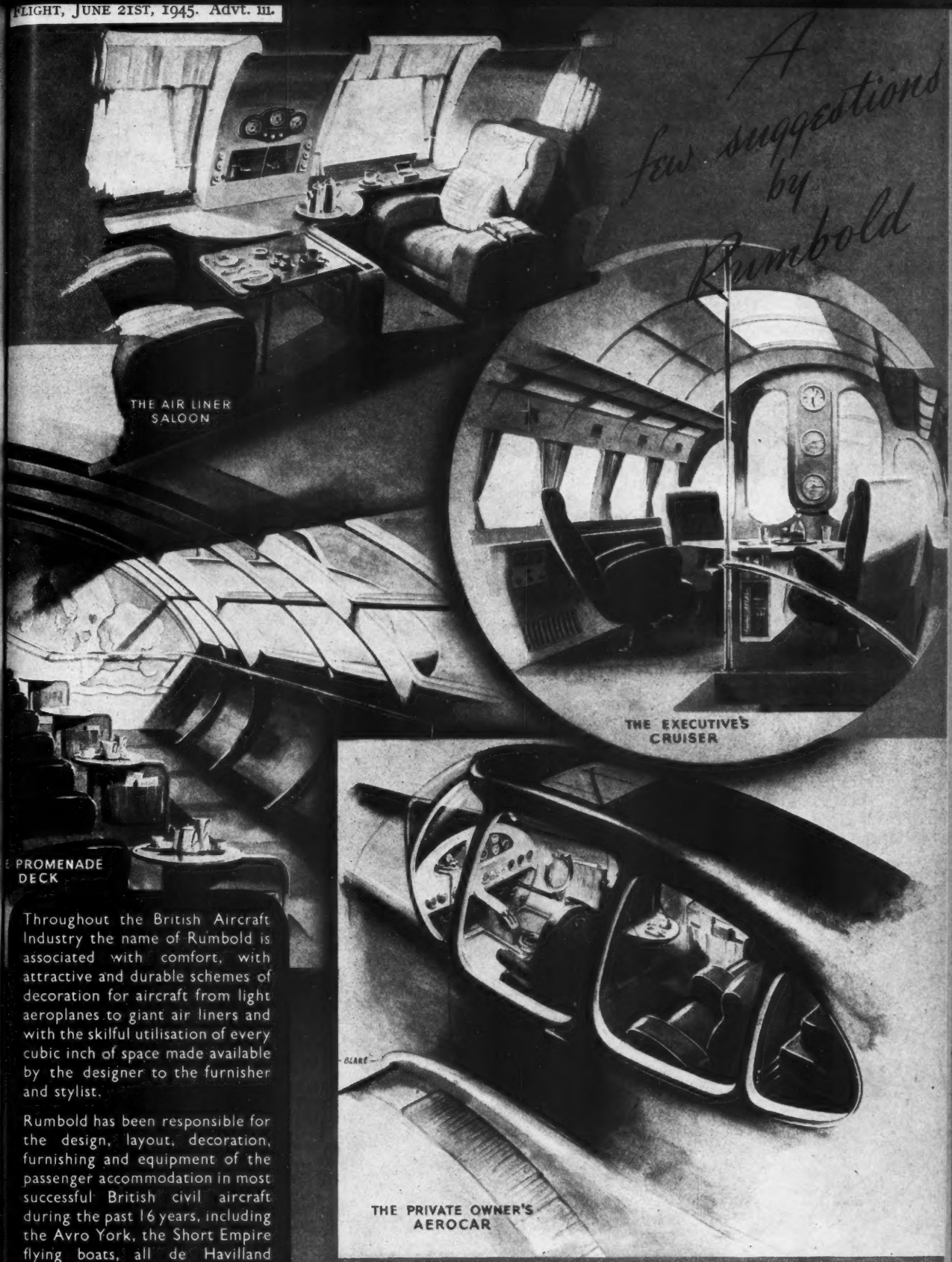
THE Air Ministry has released data of several aircraft types, one a new machine which had hitherto been secret, and the others new versions of existing types.

The Westland Welkin is a high-altitude single-seater fighter with two Rolls-Royce Merlin engines. On the starboard side there can be a 72 or a 76, and on the port side a 73 or a 77. The port engine in either case drives the cabin supercharger. Armament is four 20 mm. cannon in the nose, and the loaded weight is 17,500 lb. Maximum speed about 385 m.p.h., and maximum range about 1,500 miles. The wing span is somewhat impressive for a single-seat fighter, viz., 70ft. This, of course, is due to the great operational height. The wing area is 460 sq. ft. The pilot is accommodated in a pressure cabin. Only a small number were built, and the machine did not go into combat service.

It is disclosed that the Short Sunderland Mark V has four Pratt and Whitney engines of the R-1830 type. Max. bomb load 2,000 lb. The machine carries depth charges, and the armament comprises one 0.303 Vickers gun in the nose turret, four 0.303 Brownings in the tail turret, and two 0.303 Brownings in the mid upper turret.

The Handley Page Halifax VI has four Bristol Hercules engines of 1,800 h.p. each. Its maximum bomb load is 13,000 lb. At a gross weight of 68,000 lb. the maximum speed is 312 m.p.h. and the range over 2,000 miles.

The Vickers-Armstrongs Warwick V is a general reconnaissance bomber. The interesting point is that it has two Bristol Centaurus VII engines of more than 2,500 h.p. each. The maximum bomb load is 6,000 lb., and the machine can carry mines or depth charges. The gross weight is 45,000 lb., and the maximum speed 295 m.p.h. This type is in service with Coastal Command in South-East Asia.



Throughout the British Aircraft Industry the name of Rumbold is associated with comfort, with attractive and durable schemes of decoration for aircraft from light aeroplanes to giant air liners and with the skilful utilisation of every cubic inch of space made available by the designer to the furnisher and stylist.

Rumbold has been responsible for the design, layout, decoration, furnishing and equipment of the passenger accommodation in most successful British civil aircraft during the past 16 years, including the Avro York, the Short Empire flying boats, all de Havilland models from the Puss Moth to the Flamingo, the Armstrong-Whitworth Ensigns, the Airspeed Couriers and Envoys, the Miles and the Percival ranges and scores of other types.

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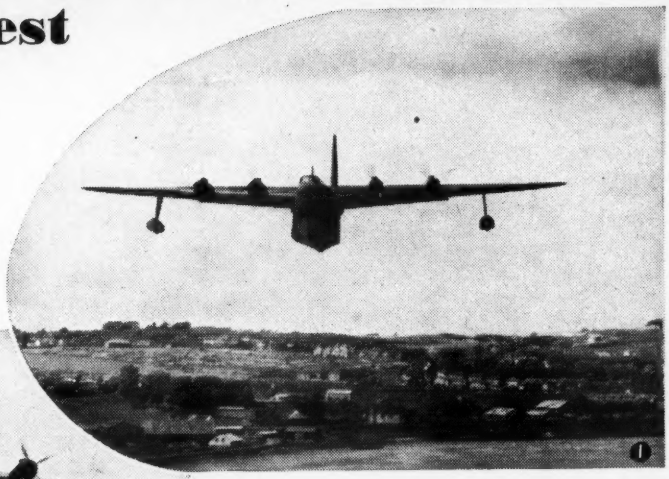
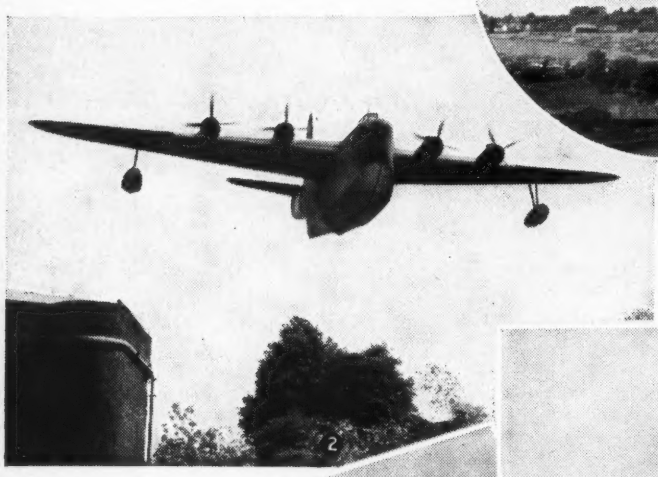
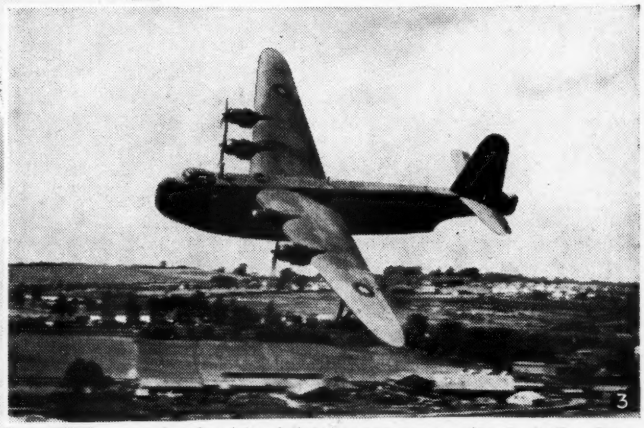
Some More Pictures of the Short Shetland

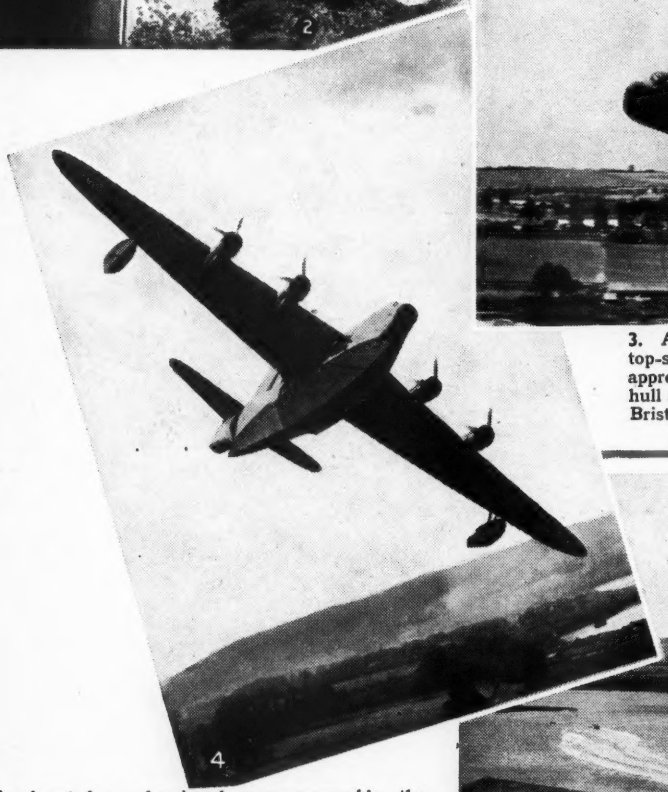


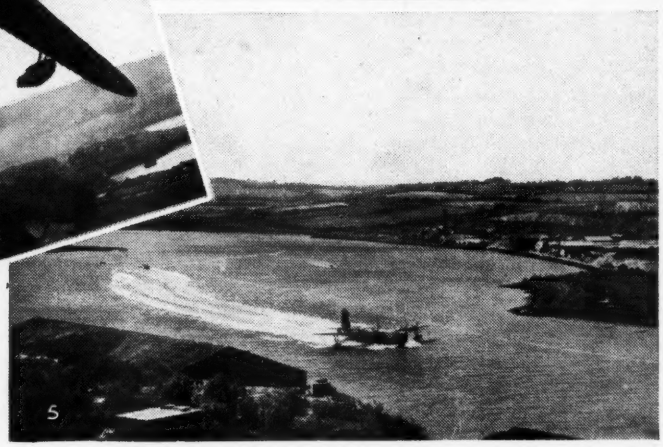


1 and 2. These views show the clean layout of the Shetland and it is not difficult to see how the excellent performance figures are achieved. The wing span is 150ft. and the hull beam 12ft. 6in. In the top photograph the flaps are partly extended.



3. A trick of lighting appears to give the hull a flat top-surface. It is difficult, from this view, to appreciate actual size because of the good proportion of hull shape and size to wing span. The four 2,500 h.p. Bristol Centaurus engines with their 15ft. 9in. diameter airscrews appear quite small.





4. Apart from showing how manœuvrable the Shetland is in the hands of Short Bros. chief test pilot, G. A. V. Tyson, the typical Short wing outline is accentuated in this photograph.

5. One of the advantages of flying-boat operation is the short landing run.

By filming the aircraft through a grid of wires, take-off run, acceleration and rate-of-climb can be accurately measured.

Simple Performance Testing

How the Ranger Aircraft Engine Firm Determines Take-offs, Climbs, Glides and Landing Runs

COMPLETE performance testing of aircraft is a complicated business, as those will agree who heard Mr. E. T. Jones lecture on the subject to the Royal Aeronautical Society in February of last year, or who have since read his paper in the R.Ae.S. *Journal*. Few, if any, private companies could afford the expense of the necessary equipment, not to mention the considerable personnel required to carry out the tests. Such work is, therefore, left to Government establishments specially equipped and staffed for the purpose.

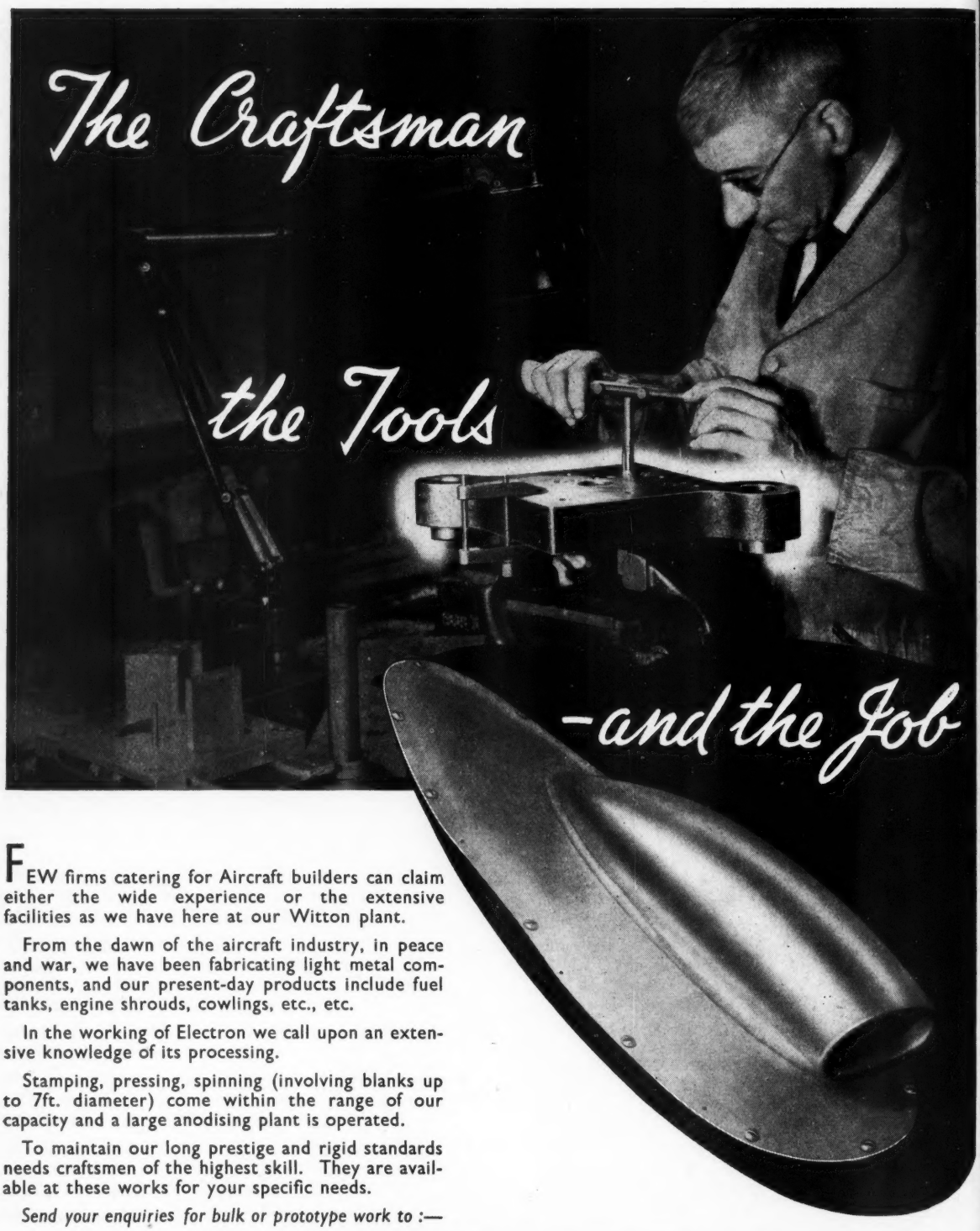
There are certain aspects of performance, however, for which tests at the manufacturer's airfield are frequently required, and the equipment for which need not be either expensive or complicated. Take-off and landing runs can be measured with a tape on the ground, but these distances do not always, by themselves, give all the information needed. Angles of glide during an approach, speed of glide and distance run from touchdown to standstill, give a much more complete picture. Or, again, with the take-off run it may be desired to couple acceleration up to the moment of "unsticking," and speed and angle of climb from that point onwards, as far as the clearing of an obstacle of given height.

A very simple technique for obtaining an accurate record of such tests has been evolved by the Ranger Aircraft Engines division of the Fairchild Engine and Airplane Corporation. The outfit merely comprises a motion-picture camera and a wire screen grid. The camera, a Bolex coupled to an intervolometer set, is placed five feet from the screen. It is set to take four frames per second.

The wire screen grid is 10ft. long and 30in. high, and the mesh, or spacing of the wires, is 1.2in., so that there are 100 squares in the length of the screen and 25 in the height. Now obviously an aircraft which taxies past the screen on the side opposite to that on which is the camera can be photographed on the film, and if the distance between the screen and the aircraft is known, each square on the grid will represent a certain distance. In this case the screen is placed 1,000ft. away from the runway, and each square represents 20ft. of runway, at least over the central part of the screen. Similarly, of course, the vertical side of the square represents a height of 20ft.

Camera-plotted Graph

It will be seen that by combining the distances ascertained from the screen measurements and the fact that four separate pictures are taken every second, it is possible to measure quite accurately such things as acceleration and deceleration, in addition to speeds and angles of climb or glide. In fact, the camera plots a graph in which the aircraft itself, or some part of it, forms the "dots." For measuring the angle of incidence of the wings in either straight flight or in a climb or glide, a black line is painted on the fuselage of the aircraft. The



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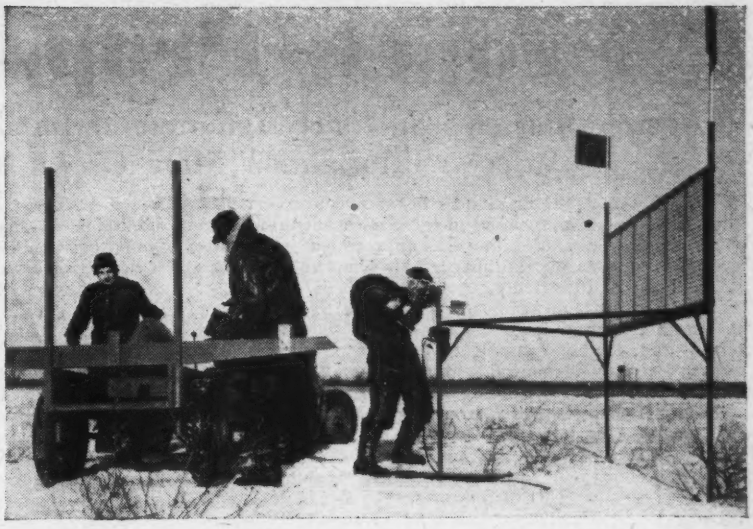
SIMPLE TESTING

angular difference between this line and the wing chord is known, and thus the wing incidence to the flight path can be ascertained.

So far as we are aware, the Ranger corporation is the first aircraft engine firm to set up such a test rig. At Farmingdale, Long Island, the rig is used largely for testing the efficiency of various engine-airscrew combinations on a Fairchild PT-19 powered by a 175 h.p. Ranger Six engine. Performance can be checked when airscrew changes are made, such as from fixed to variable pitch, or various pitch settings of adjustable airscrews, and the effects of such changes on performance. The resulting film is projected and the graph drawn from it gives the required information.



Setting-up the camera, which takes four frames per second. It is located five feet from the wire grid, the meshes of which measure 1.2in.

Birthday Honours

Many Service and Industry Awards

IN accordance with long-established custom His Majesty the King, on the occasion of his birthday, has bestowed a number of honours and awards on members of the fighting services, civilian officials, scientists and members of industry.

In the following list are those names which have aeronautical significance. A further list will be published next week.

BARONET

Air Chief Marshal Sir Wilfred Rhodes Freeman, lately chief executive, Ministry of Aircraft Production.

KNIGHTS BATCHELOR

Sqn. Cdr. James Bird, R.N.A.S. (retd.), general manager, Vickers-Armstrongs, Ltd., Supermarine Production.

Harold Stanford Cooper,, joint managing director, Ford Motor Co.

James Temple Cotton, lately Under-Secretary, Ministry of Aircraft Production.

Reginald Watson Watson-Jones, F.R.C.S., L.R.C.P., civilian consultant to R.A.F.

ORDER OF THE BATH

K.C.B.

Sir Frank Newton Tribe, Permanent Sec., Min. of Aircraft Production.

C.B.

W. B. Foden, Asst. Under-Sec. of State, Air Ministry.

ORDER OF ST. MICHAEL AND ST. GEORGE

C.M.G.

F. W. Musson, Controller of Programmes and Admin., British Air Commission, Washington; Grp. Capt. J. F. Venner, A.A.F., Civil Asst., Air Ministry.

ORDER OF THE BRITISH EMPIRE

C.B.E.

R. M. Jones, Asst. Sec., Air Ministry; E. Mensforth, Vice-Chairman, Westland Aircraft, Ltd.; Air Cdr. H. P. Smyth-Osbourne, Comdt. S. W. Command, A.T.C.; T. C. L. Westbrook, Production Contoller, de Havilland Aircraft Co., Ltd.

ORDER OF THE BATH

ROYAL AIR FORCE

G.C.B. (Military Division)

Air Chief Marshal Sir Arthur Travers Harris, R.A.F.

K.C.B. (Military Division)

Air Marshal Charles Edward Hastings Medhurst, R.A.F.

A.V-M. George Ranald Macfarlane Reid, R.A.F.

C.B. (Military Division)

A.V-M. K. M. St. C. G. Leask, R.A.F.; A.V-M. G. H. Mills, R.A.F.; A.V-M. H. K. Thorold, R.A.F.; A.V-M. J. A. Gray, R.A.F.; Air Cdre. C. A. Bouchier, R.A.F.; Air Cdre. C. P. Browne, R.A.F.; Air Cdre. H. L. Crichton, R.A.F.; Air Cdre. L. Darvall, R.A.F.; Air Cdre. W. I. Dawson, R.A.F.; Air Cdre. H. E. Forrow, R.A.F.; Air Cdre. F. J. Fressanges, R.A.F.; Air Cdre. H. B. Russell, R.A.F.; Brig. J. T. Durrant, S.A.A.F.; Air Cdre. G. W. Tuttle, R.A.F.

ROYAL AIR FORCE AWARDS

Bar to Air Force Cross

Grp. Capt. D. H. V. Craig, R.A.F.

Air Force Cross

Grp. Capt. D. Ll. Amlot.

Wing Commanders: P. J. Cundy, R.A.F.; D. W. Edmonds, R.A.F.O.

Squadron Leaders: J. Clayton, R.A.F.; J. R. Goodman, R.A.F.V.R.; K. S. Booth, R.A.F.V.R.; D. I. Chapman, R.A.F.V.R.; W. S. Chubb, R.A.F.; G. W. Couzens, R.A.F.; B. R. Hall, R.A.F.; N. L. Haworth-Booth, R.A.F.V.R.; W. S. Kennedy, R.A.F.V.R.; W. I. Lashbrook, R.A.F.; J. G. S. Linacre, R.A.F.V.R.; R. A. Marsh, R.A.F.O.; M. J. P. Martin, R.A.F.V.R.; A. C. B. Morgan, R.A.F.V.R.; W. R. Morris, R.A.F.V.R.; W. A. Mostyn-Brown, R.A.F.; I. C. Murison, R.A.F.O.; G. Rees, R.A.F.; P. H. Stembridge, R.A.F.V.R.; T. A. Stewart, R.A.F.V.R.; D. H. Stuart, R.A.F.O.; F. H. Stubbs, R.A.F.

Flight Lieutenants: D. Ames, R.A.F.V.R.; J. E. Atkins, R.A.F.; E. Bates, R.A.F.V.R.; J. C. Blair, R.A.F.V.R.; F. R. Bolton-Smith, R.A.F.V.R.; A. D. Burt, R.A.F.; W. Cummins, R.A.F.; F. W. Dewell, R.A.F.; W. A. Doherty, R.A.F.; G. F. R. Duffy, R.A.F.; E. P. Eastment, R.A.F.; R. A. Gifford, R.A.F.V.R.; H. C. Graham, R.A.F.V.R.; D. F. Greig, R.A.F.V.R.; T. A. Hampton, R.A.F.O.; F. C. Heavery, R.A.F.V.R.; A. F. Herbert, R.A.F.V.R.; A. Johnstone, R.A.F.V.R.; J. T. Lawrence, R.A.F.V.R.; A. E. Lomas, R.A.F.V.R.; L. A. Martin, R.A.F.V.R.; D. J. Mason, R.A.F.V.R.; S. R. Pemberton, R.A.F.V.R.; J. Procter, R.A.F.V.R.; A. L. Roberts, R.A.F.; H. Rogers, R.A.F.V.R.; T. M. Scott, R.A.F.V.R.; J. Shearsmith, R.A.F.; C. F. Smith, R.A.F.; R. A. H. Smith, R.A.F.; L. E. Tarplee, R.A.F.V.R.; G. N. Taylor, R.A.F.V.R.; R. S. Taylor, R.A.F.V.R.; W. P. Tudor, R.A.F.V.R.; G. Williamson, R.A.F.V.R.; R. R. Lord, R.A.F.V.R.

Flying Officers: A. E. Binham, R.A.F.V.R.; J. S. Birkett-Evans, R.A.F.V.R.; C. L. Boulding, R.A.F.V.R.; R. W. H. Bray, R.A.F.V.R.; E. J. Churchill, R.A.F.V.R.; F. Norton, R.A.F.V.R.; F. W. Ruddle, R.A.F.V.R.; G. M. Rutherford, R.A.F.V.R.; G. A. Stafford, R.A.F.V.R.; J. Stonier, R.A.F.; J. Whelan, R.A.F.

P/O. R. W. Court, R.A.F.V.R.

Warrant Officers: F. T. H. Brewer, R.A.F.V.R.; E. W. Kennett, R.A.F.V.R.; H. McMillan, R.A.F.V.R.

(To be continued next week.)

"Indicator" Discusses Topics of the Day

Proper Propaganda

"Average Person" Sublimely Ignorant of Important Facts Concerning Safety : Information More Useful Than Slogans

REMEMBERING mankind's instinctive fear of height and the racial memory of the unpleasant things that gravity can do to the unprotected vertebrate mammal, it is an extraordinary thing that we have ever taken, even half-heartedly, to the air. It is, I suppose, just another example of the way in which the courage of the mind can beat down the quaking of mere flesh and blood—and another example of the sort of thing which, despite Belsens, Buchenwalds and Dachaus, gives us hope that we may eventually struggle out of the pit.

Though I think we are deceiving ourselves if we imagine that, even if they can afford to do so, a very large proportion of ordinary people will take immediately to the air as soon as convenient services are made available, there is, however, one marked difference between the international traveller of 1939 and his counterpart of 1945. He is now ready to accept air transport as part of his daily life and is ready to use it once he is convinced of its safety, economy and comfort. For five years his skies have been incessantly crowded with various types of flying machine, and for five years his news services have spoken casually of almost astronomical numbers of aircraft which have gone out daily on raids and sorties in different parts of the world. By habit he may have learnt to think that these aircraft always stay in the air unless adversely affected by enemy action, and if he dislikes them at all it is merely because some of them have had a nasty way of dropping noisy and lethal projectiles out of their bellies.

The difficulty will be that of convincing the average person that air travel has any particular interest for him—in other words, that it is a safe, inexpensive, comfortable, and usefully reliable way of getting about. That, in fact, flying is an ordinary thing and will take its place in the world's transport system as a special supplement to the existing services.

Convenience Only

Of course, it should not be necessary to publicise air travel, and I am certain that no ordinary propaganda drive, with all the ingenious slogans that can possibly be invented, will have more than the slightest influence on the travelling public. Why should it? People are not going to pay high fares and, in the opinion of some, risk their necks, simply because they are told that it is a "good" thing to do, that "Britain's Future is in the Air," or something-or-other. Our future is in the air only if the use of aircraft can increase our trade and general prosperity. Travellers don't board ocean liners because we're a maritime nation and because it's "in our blood" to board liners. They merely want to get somewhere else and we happen to be living on an island. We're a maritime nation because, in order to survive, we had to be. That and nothing more.

Results are the best propaganda in the world. After the air transport system has been working for a year or two, with few accidents, a good standard of regularity and reasonable but economic fares, people will certainly make use of it. All we can hope to do in the meantime is to give the general public the most complete and interesting information about the whys and wherefores—with no trimmings other than those required to make the subject interesting.

One has only to talk casually to an average person who is not directly or indirectly concerned with aviation, to realise that his or her ignorance is profound. And ignorance is the sole cause of any fears and doubts that remain. Probably nearly fifty per cent. of the public still think that, if the motor or motors stop, then the contraption will fall lethally to the ground, and I doubt if one in a hundred has the faintest inkling of the organisation involved in maintaining a high standard of airworthiness. They certainly don't realise that both the organisation and the high standard have remained almost unmodified during a war the intensity of which might have justified, at least during the black years, an almost unlimited reduction in safety values. Standards of workmanship, inspection, and testing have remained at such a high level that one fighter or one bomber picked out of a thousand at random, is as safe to fly as any peacetime transport aircraft.

Average Opinion

To the average member of the public an aircraft is just a noisy, complicated and potentially unreliable piece of mechanism maintained in flight by a mysterious collection of aerodynamic forces—understood only by few—and guided by still more mysterious and complicated radio "gen boxes" of one kind or another. Yet every member of this same public has some general idea of the way in which the signal system of a railway functions in order to ensure his safety, and of the way in which an ocean-going liner is guided across the Atlantic. It would not be too much to say that my "average" person is, so far as aircraft are concerned, at the same stage of ignorance as the person who, a century ago, saw no reason why an iron ship should do anything but sink to the bottom, and who suspected that the noise and speed of railway travel would assuredly ruin his lungs, nerves and eyesight in no time at all.

There should be no need to suggest, untruthfully, that aircraft are reliable in detail—there are few mechanisms which operate by virtue of the co-relation of so many different items. Simply that, in spite of the endless possibilities of minor failure, the standards of maintenance and inspection are high enough to ensure a degree of overall mechanical reliability equal to that of other transport devices. By means of duplication, frequent inspection and replacement, the initially larger possibilities of failure are successfully counter-balanced. It might even be good practical propaganda for the A.I.D. to insist on the complete replacement of certain of the more highly-stressed parts after a certain definite number of flying hours—rather after the fashion in which, for instance, colliery winding ropes must, by law, be changed, regardless of their inspected condition.

Replacement schedules are, in fact, laid down and are rigidly observed where aircraft are concerned, while the life of a complete aircraft can rarely be expected to exceed that of any of the major items in the structure. But the public does not know about these schedules. A series of factual advertisements giving information of this kind would be more effective than any number of merely enthusiastic assurances that "the air is the thing." On the rare, but unfortunately well-publicised, occasions when a transport aircraft crashes or disappears, the public is so often left to think that aircraft are, in themselves, unreliable. Mechanical failures do occasionally occur, but it is not often that such failures do more than contribute to the loss of an aircraft in conditions which are otherwise vitally unfavourable. The need for feathering one of the four motors is of small account unless unexpectedly bad weather is met; the failure of the fuel transfer system, for instance, is only serious when, owing to weather conditions, no intermediate landing is possible; and so on. In peacetime transport planning even the most unlikely failure of a duplicated essential will be allowed for in the operational schedules.

The public, too, should not be given the idea that all

wartime progress has been good and useful progress. War conditions have, in many cases, developed over-efficient and over-complicated aircraft, and a certain amount of back-pedalling will be necessary if we are to find that air services are commercially practicable from the costing point of view. Into the designer's calculations will enter all-important maintenance and replacement points—overlooked during a war in which cost of operation has been unimportant—and the resulting simplification in layout will improve the average of reliability. The transport aircraft of the future will be no "civilised" version of the present-day bomber type—it will, I hope, be laid out on lines in which the annual running, replacement and maintenance costs will take precedence over performance and even over load-carrying efficiency.

But until the public are in a position to learn about such things, they cannot be expected to rush confidently into the passenger seats of machines which have been, until now, mysterious and even miraculous in their goings and comings. "INDICATOR."

Navy Appoints First Air Admiral

Co-ordination of Commands at Home Bases

THE important changes in the direction of the Naval Air Arm, recently foreshadowed exclusively in *Flight*, have now been made known in an Admiralty announcement and a statement from the Ministry of Information. Essence of the announcement is that Vice-Admiral D. W. Boyd, C.B., C.B.E., D.S.C., R.N., takes up a newly created appointment as Admiral (Air) following his departure from the appointment of Fifth Sea Lord, which is now held by Rear-Admiral T. H. Troubridge.

The significance of this new appointment is far deeper than it may superficially appear to be. It means that as the representative of the Service side of the Naval Air Arm stands a man of drive, initiative and resource (with which is coupled a charm of manner and temperament which scissors through unnecessary Red Tape). It means that the chief naval officer for Service air affairs in Britain is an officer of outstanding record in direct contact with naval flying, whose "opposite number" on the policy side in the Admiralty, Admiral Troubridge, has a parallel intimate acquaintance with carrier operations.

Vice-Admiral D.W. Boyd, C.B. C.B.E., D.S.C.

Full details of the changes have not been disclosed, and it is likely that a short time will elapse before the new régime makes its full influence felt. In brief, it may be explained that before the appointment of Admiral (Air) there was a triple division of naval air direction in the Service at home bases. These were R.A.N.A.S.—(Rear-Admiral Naval Air Stations); R.A.N.A.S. (N.)—(Rear-Admiral Naval Air Stations Northern); and F.O.C.T.—(Flag Officer Carrier Training). Respectively these dealt with (1) all naval air stations at home, but with delegation of much routine work to (2) R.A.N.A.S. (N.), based at Donibristle; and (3) carrier training of squadrons working up to operational standard.

It seems that the Admiral (Air) intends to make a somewhat similar but in fact quite different division of duties by the introduction of Groups or Commands (on a not dissimilar basis to R.A.F. Commands). There may, therefore, be a Training Command, in which all the initial stages of naval aviation are carried through; a Carrier Training Command, in which the second stage of working up to fighting strength is reached and squadrons are prepared for embarkation in the operational carriers; and thirdly a Reserve Aircraft Command, which will deal with supply of aircraft and equipment, and with maintenance and repair. These titles may be subject to change, but the functions are clear.

It is, therefore, of much interest to see in the M. of I. statement that Rear Admiral Slattery has also been elevated to a new appointment. For long Admiral Slattery has been the man behind the scenes in the equipment of the Naval Air Arm. During his time at M.A.P. the equipment of the Naval Air Arm has made considerable advances—he has seen the Swordfish speed surpassed by at least 200 m.p.h. and the technique of deck flying correspondingly adjusted to meet the new era of speed at sea . . . .

Admiral Slattery becomes Vice-Controller (Air) yet he retains his M.A.P. position of Chief Naval Representative. His Admiralty appointment, on the supply side, means that he holds administrative power in the Admiralty, and can thus short-circuit much of the network of complicated channels of communication between M.A.P. naval side and the Admiralty which existed prior to this arrangement.

It is significant that Admiral Slattery has also first-hand air knowledge, and in fact was one of the first course of naval pilots at Netheravon twenty years ago.

Thus, for the first time, at the head of the policy side, the Service administrative side, and the M.A.P. plus Admiralty supply side, has come into being a triumvirate of high officers of proven ability and distinguished record—each fired with an enthusiasm for the promotion of naval aviation.

With the right men at the top, it seems that a bright future faces the Navy's air side, not a little because of the paradoxical situation *vis-à-vis* the R.A.F. That Service has ended the major air war with full superiority in the air—with an unequivocal lead especially in the heavy bomber and fighter classes. However, every schoolboy with a telescope knows full well that even better bombers and fighters of many categories were on the verge of introduction when the Huns were defeated.

The R.A.F. is to be cut by one-third of its personnel in the coming months, and its foremost aircraft of to-day will surely be far outmoded by those in being, about to come into being and on the drawing boards for 1948 appearance. Therefore it is clear that the Naval Air Arm can step in with a clear field for the interim years, and during coming months avail itself of the brilliant aircraft which would have appeared had not the war in the West terminated.

With this aspect of an ascendant air power at sea must be coupled the decline of influence on design by the Observers whose partiality for flying schoolrooms has so much governed design ideas in the past. With the transition into the higher categories of fighting aircraft and the versatility of employment which war has shown to be available in aircraft of basically sound design (*vide* Spitfire and Mosquito), it may well be that the Admiralty will in future go to the aircraft constructors and say: "You build the best aircraft you possibly can for attack or defence, and we will then see how to adapt them for other duties as required." In effect, such a policy would completely reverse that so far existing, in which Naval Air Arm aircraft have been regarded as special-duty aircraft.

One other interesting point is the full insistence on the term Naval Air Arm and the dropping of the now familiar phrase "Fleet Air Arm." The F.A.A. was not a successor to the old R.N.A.S., which never operated from aircraft carriers in the modern sense. The F.A.A. came into being as a 1923 political compromise between the Air Ministry and Admiralty, and was a hybrid force composed of R.N. and R.A.F. personnel. The modern "naviators" cannot therefore be regarded as "Fleet Air Arm" since no R.A.F. officers or men are nominally in its ranks. B. J. H.

M.A.P. Exhibition

Showing the R.A.F.'s Fine "Tools to Finish the Job"

ORDER AMID CHAOS: The blitzed background may have dramatic value.

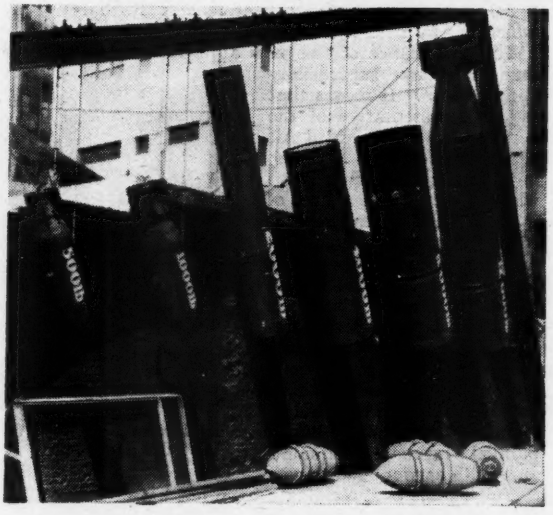
TO-DAY marks the opening of the exhibition officially designated "Britain's Aircraft," organised by the Ministry of Aircraft production in conjunction with the Campaign and Exhibits Division of the Ministry of Information, sited amid the bombed-out premises of John Lewis & Co., Ltd., in Oxford Street, London. The opening time, originally fixed for noon, was advanced to 11.30 a.m., and Lord Beaverbrook, having been the first Minister of Aircraft Production, was chosen to perform the opening ceremony.

In *Flight* of June 7th there appeared a description of the scope and nature of this exhibition, together with a plan of its layout, and as a whole page was devoted to this advance reference there is no point in recapitulation. At the time of going to press with the present issue, the exhibition was hardly in a sufficiently advanced stage of preparedness to enable a description of its presentation to be prepared, but this will appear in the next issue of *Flight* on June 28th, with as many illustrations as space permits.

Preparations

To-day we publish three pictures taken during the earlier stages of the exhibition's preparation. The top photograph will give some idea, to Provincial and overseas readers who are not familiar with this blitzed corner of London, of the decidedly unpromising surroundings in which those responsible for the exhibition's layout have been obliged to work. On the other hand it might be said that there is a certain dramatic value in staging a demonstration of Britain's present air power in a space blasted open by German bombers while that air power was still being doggedly built up. It is not suggested, however, that any such poetic thought actually dictated the choice of this site which, in any case, has been the scene of previous exhibitions. How well the technicians have overcome the handicaps of the site will be decided by the general public as from to-day.

The middle picture is of an exhibit which may be taken as aptly symbolic of the steady increase in the R.A.F.'s striking force—an increase only possible through the scientific progress made by the celebrated "back-room boys" working for M.A.P. This, of course, applies not only to the bombs depicted here, but to the aircraft which bore them to their targets ever faster, more numerously, and further afield; it equally applies to the more and more precise and complicated equipment demanded for the success of such operations.



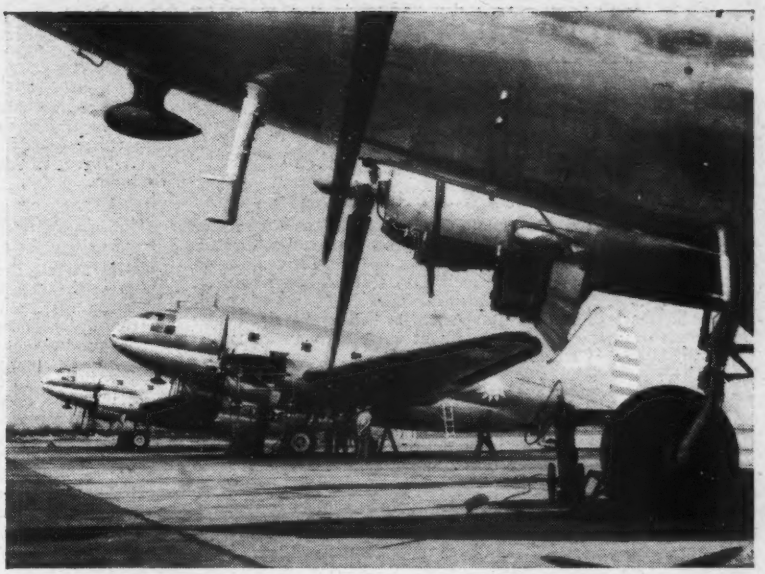
BOMBING-UP: Six symbolic stages in the growth of the R.A.F.'s striking power are depicted by this exhibit, here seen taking shape.

As will be seen in this middle picture, the bombs step up from 500lb. to 12,000lb. At the start of the war we relied chiefly on the 250lb. and 500lb. bomb, known as the "General Purpose" bomb. The 500lb. bomb was regarded as a phenomenal achievement towards the end of the 1914-18 war, but it soon became evident that something bigger and with more blast effect was needed to deal with modern steel and concrete. Thus the size and power went up via the 1,000lb., 2,000lb., the 4,000lb. "Cookie," the 8,000lb. "Blockbuster," to the 12,000lb. "Earthquake" bomb. Finally the present peak was reached with the 22,000lb. bomb known as "The Grand Slam," or more popularly as "Ten Ton Tess." This monster of destruction is honoured with a stand of its own.

The bottom picture is of the Halifax bomber "Friday 13th," whose crew defied all superstitions and completed 128 operations, including Berlin and almost every other major German target.

PREVIEW: The public crowded round the Halifax III, "*Friday 13th*," the moment it reached the Oxford St. site. They were not superstitious either!

CIVIL AVIATION NEWS



The China National Aviation Corporation operates routes in China, Burma and India under contract to the Chinese Government. These Curtiss C-46 Commando's will be used by the C.N.A.C. for flying over the Himalaya Hump.

SPLENDID RECORD

TWO Tasman Empire Airways flying boats will have accomplished together 1,000 crossings of the Tasman Sea by the end of this month.

Capt. O. Gardner, chief pilot, and two other officers have each made over 400 crossings of this treacherous sea.

MOUNTING UP

5 HOURS 52 minutes' flying time per aircraft per day, or approximately 2,140 hours per aircraft per annum, is the average of the B.O.A.C. Boeings during the period from April 1st, 1944, to March 31st, 1945.

For this year's summer operation which began on May 12th the figures will be 9½ hours per aircraft per day, or approximately 3,467 hours per aircraft per annum.

UNION FINANCE

SOUTH AFRICAN airways are expected to yield an income of S.A. £260,000 during the financial year ending March 31st, 1946. Revenue from airports is estimated at S.A. £2,000 for the same period.

Estimated expenditure in 1945-46 is S.A. £288,000 for airways and S.A. £10,000 for airports.

PANAGRA

PAN AMERICAN-GRACE AIRWAYS, INC., has been granted a U.S. C.A.B. permit to operate passengers and mail services between Lima and Iquitos, Peru, via Juanjui, Peru.

Panagra operates between the Canal Zone and Buenos Aires in South America, as well as additional local services in Bolivia and Ecuador. The newly certificated route between Lima and Iquitos would establish a connection at the latter point with Panair do Brasil, providing a through route across the centre of South America to the east coast, and will furnish air transportation to an area which is difficult to reach by other means of transportation.

CEYLON'S FUTURE

COLOMBO'S rôle as a junction in inter-continental air routes is envisaged by a correspondent of the *Ceylon Daily News*. With better range aircraft and improved ground facilities, it is said, it will be possible to extend the direct air routes from Tokyo to Colombo (via Shanghai, Chungking and Calcutta) to Diego Garcia, Madagascar, Johannesburg and Cape Town. Colombo will be linked directly to Moscow by way of Karachi and Teheran and to London or Lisbon by way of Karachi, Teheran, Ankara and Marseilles.

In connection with these optimistic views on the island's potentialities in air communications, the request submitted by the Ceylon Government to the Secretary of State for the Colonies to send an adviser on civil aviation development has met with a general public approval.

PROTEST

PROTESTING against Allied Airways (Gandar Dower) having to confine its operations north of Aberdeen, Mr. E. L. Gandar Dower stated in an announcement that permission to resume the Aberdeen-Glasgow service was refused to his company, while Scottish Airways, a railway subsidiary, have been allowed during the last three months to open several additional routes between England and in Scotland.

Allied Airways also applied in February last year to open routes from Newcastle and Aberdeen to Stavangar, Oslo, Helsingfors and Leningrad. The Government's answer to this application was confined to a cryptic postcard.

TO NEW GUINEA

A CIVILIAN air service between Sydney and Lae (New Guinea) was some time ago opened by Qantas Empire Airways. The service is at present being operated on a once-weekly basis, but the frequency is expected to be increased shortly to three times weekly. Although Lae is the present terminal, it is expected that permission will shortly be forthcoming to allow continuation to Finschaven.

EIRE'S PROBLEMS

A DETAILED study of the possibilities of internal air services in Eire had been made, but so far no economically justifiable scheme had been found, said the Minister for Industry and Commerce (Mr. Sean Lemass) in reply to a question in the Dail.

Formation of a national air service scheme, he said, was the responsibility of Aer Rianta, which was established specifically to implement the Eire Government's policy of civil aviation development.

The Minister also told the House that to assist in the selection of suitable airport sites consideration was being given to the survey of localities at which airports might usefully be established to serve the possible future needs of airline operation, air tourists and private flying. The acquisition of sites and the provision of the airports was primarily the responsibility of local authorities.

CHANGED RULES

REDUCTION in minimum age limits for a private pilot to seventeen years, a reduction in the flying time required and the elimination of navigation and meteorology in the written examination are among the significant changes introduced by the U.S. C.A.B. in their requirements for private pilots' licences. The minimum dual instruction has been raised from eight to ten hours, the first solo left to the decision of the instructor.

Of considerable interest to American glider pilots will be the provision for appropriate credit for glider time towards powered aircraft rating.

One of the most important changes is the elimination of horse-power rating on the basis of which recent experience in an aircraft in a horse-power range within 50 per cent. of that of the aircraft to be flown is required within the preceding ninety days if passengers are to be carried. Solo flights are permitted in any type of aircraft by a pilot holding a valid licence regardless of his particular aircraft rating.

CIVIL AVIATION NEWS

TALLY HO!

A THREE-DAY coyote hunt by air was staged recently in Western Oklahoma, U.S.

U.S. SENATE HEARINGS

THE chairman of the Senate Foreign Relations Committee announced the appointment of a five-man sub-committee on aviation to conduct open hearings on the Convention on International Civil Aviation which the late President Roosevelt submitted to the Senate for ratification.

Public hearings on the Convention have been arranged, and witnesses from the State Department Civil Aeronautics Board and U.S. airline companies were invited to appear.

RETURNING TO CANADA

THE United States may soon relinquish responsibility for at least some of the airfields on the so-called "Crimson" aviation route linking Western Canada with Europe via the North Atlantic.

Churchill, Manitoba, 1,000 miles from Winnipeg, forms the main base of the north-west staging route.

It will be recalled that Prime Minister Mackenzie King announced in August, 1944, terms under which the Canadian Government has arranged to take over all U.S. interests in permanent wartime air installations, and made known the existence of four hitherto undisclosed airports in Northern Canada, each costing more than $7,000,000.

The actual cost of the obligation assumed by the Canadian Government in Canadian funds is close to $120,000,000, covering the north-west staging route from Edmonton to Alaska, a telephone line from Edmonton to Alaska, and the north-east staging route.

TUDOR TAKES A BOW

AVRO Tudor I, Britain's first civil air liner to take the air since the end of the war in Europe, has made a successful test flight at Ringway, Manchester. The tests were carried out by Messrs. Bill Thorn and Jimmy Orrell.

Designed specially for long-range flights, the Tudor I is a low-wing monoplane with single tail fin and rudder and with a span of 120ft. and a length of 85ft. Its gross weight is 76,000lb.; a pressurised and air-conditioned cabin for high altitude flying can accommodate up to 24 passengers.

The Tudor is powered by four Rolls-Royce Merlins which give it a maximum speed of 346 m.p.h. at 20,000ft. Max. cruising speed is 295 m.p.h. at up to 25,000ft., and max. cruising range 4,980 miles.

Commenting upon the Tudor's debut, Mr. Roy Chadwick, the well-known Avro designer, called it "the most wonderful day in British civil aviation." He said that the first order for two Tudor I's for the B.O.A.C. will be completed at the Avro works at Chadderton, near Manchester, and that several machines will be ready for use on the U.K.-Montreal service by the end of this year and will replace the Lancastrians. The Tudor I is scheduled to fly non-stop to Montreal in 12 hours.

He and his team of designers, Mr. Chadwick added, are now working on the Tudor II, a 60-passenger air liner for the Empire air routes.

B.O.A.C. SERVICES

THE Mosquito service to Stockholm, which has been such a prominent feature of B.O.A.C. wartime operations, has been cancelled and replaced by a service operated with Dakotas (*Flight*, June 14th, 1945). Aircraft leave daily Croydon and Bromma simultaneously at 0900 hours G.M.T. (11 a.m. B.D.S.T.).

This is one of the four new services inaugurated by the Corporation since VE-day. The others are: the United Kingdom-Australia service operated with Lancastrians leaving Thursdays from Hurn, and in the opposite direction from Sydney; the United Kingdom-Karachi service, leaving Hurn Mondays and Thursdays with Dakotas, which started on June 4th; and the Lodestar Cairo-Nairobi twice-weekly service in both directions, with a night stop at Khartoum.

On other B.O.A.C. lines several changes have been made to improve services. The U.K.-India service operates with Sunderlands twice weekly to Calcutta and return and four times to Karachi and return. The new schedule reduces transit time in both directions by one day, and it will include Marseilles as an additional port of call.

On routes radiating from Cairo the Sunderland service to Karachi is now operated three times weekly in both directions, with the transit time reduced by one day, and the schedule of the thrice-weekly service to Calcutta with "E" class flying boats has been amended to permit lunching on the ground at Bahrein.

OPERATORS' REACTIONS

FOLLOWING upon the recent Government announcement modifying the White Paper on Civil Aviation (*Flight*, June 14th); the Association of British Aircraft Operators has issued a statement expressing its approval of the proposed setting up of a licensing authority. The Government's promise that pre-war licensed companies may resume their routes and that any company may apply for new routes is recognised as a concession, but the association registers disquiet at the fact that the extensive network of Scottish Lines should be assigned to a monopoly company.

"It should be emphasised," the statement says, "that if a large number of routes are handed to the monopoly, pre-war operators will have no room for expansion and there will be little left for a new company to develop."

The association is of the opinion that there is ample scope for at least five British companies, and it draws attention to the success of American aviation, which "leads the world, with nineteen Free Enterprise Companies, an increasing number of which are being permitted to operate internationally."

The association has received complaints from members that the Minister of Civil Aviation declines interviews with independent operators, but consults regularly with constituents of the proposed monopolies.

INDIA'S POLICY

THE Government of India have approved an initial post-war air transport plan providing daily internal services established and operated by private commercial organisations on a series of trunk routes totalling more than 11,000 miles. It is planned to operate these services with aircraft of twelve to twenty passenger capacity carrying additional mail and freight loads.

Critics of the Government plan hold that the scheme gives no indication as to what trunk routes will be established, what the ground facilities will be, and what arrangements are being made for the training of Indian personnel.

The Government policy they say is modelled on the British White Paper, and yet unlike Great Britain it does not propose to associate railways and shipping under a co-ordinated scheme. It is pointed out that the limited number of private companies operating on profit basis is bound to create monopolies with all their attendant evils. The Government of India, it is argued, should have planned their post-war civil aviation policy on State ownership and management, and should have created the necessary machinery to co-ordinate all forms of transport.

FROM LATIN-AMERICA

AEROVIAS DE GUATEMALA, S.A., the domestic airline, has been expropriated by the Guatemalan Government, which is now forming a new air transport company to operate internal routes. Thirty per cent. of the new company's capital will be subscribed by the Government, 55 per cent. by the local investors, and 15 per cent. will be disposed of to a foreign concern providing technical guidance and assistance.

A Civil Aviation Club, sponsored by the Government, is to be set up to promote private flying.

* * *

DETAILED topographical studies for a new national airport for Panama, have now been completed by the Engineering Division of the Panama Canal.

The airport is scheduled to be completed in spring, 1946, and construction plans are now being drawn up.

* * *

IN Cuba lack of adequate steamship passenger services contributes to the increase in air traffic. According to recently published statistics for 1944, incoming aircraft numbered 6,188 and outgoing 6,187, compared with 4,565 and 4,589 respectively in 1943. Incoming passengers in 1944 numbered 26,233 and outgoing 29,006 as against 20,545 and 20,128 in 1943.

Freight carriage also shows steady increase, rising from 574,354lb. in 1942 to 659,367lb. in 1943 and 825,787 during 1944.

Bomber Command's Offensive

Full Official Story, Giving Facts and Figures, of Five-and-a-half-years' of Night Bombing

MANY details of the air battles fought in darkness over Germany by the strategic bombing force of R.A.F. Bomber Command have so far had to remain secret to avoid helping the enemy. Often the Germans were ignorant about tactical developments, but now it is possible to give some account of the five-and-a-half-years' struggle. At the same time, with the occupation of Germany it has also become possible to understand more clearly than before the full scope of Bomber Command's achievement.

The tactics of night bombing are different in almost every particular from those of day-bombing, though the strategy of both is essentially the same. It was just as essential to gain and exploit air superiority by night as by day, in order that German war industry should be crippled, German communications destroyed, and the way prepared for the Allied armies to land on the Continent and invade Germany. But no pitched battle has ever been fought between the bomber force and the German defences; it has always been a matter of single combat between bomber and fighter, with all the advantage, once the combat had begun, on the side of the fighter. For Bomber Command the main object of bomber tactics was therefore to gain air superiority by preventing the fighter from joining battle with the bomber; to outmanœuvre the German Air Force rather than to destroy its defensive aircraft outright in the air.

Bomber Command dropped 955,040 tons of bombs in 392,137 sorties. Of these 657,674 tons fell on Germany and 297,366 elsewhere.

High Explosive	***Incendiary***
758,685 tons.	***196,355 tons.***

It was inevitable that the enemy should end the war with a powerful night force still intact. He had maintained a front-line strength at some 800 night fighters for a long time and the force was still there at the end of the war, though latterly it had been unable to operate with full effect because of lack of petrol. But this did not mean that the battle had not been completely won. On the contrary, the night fighter force had persistently failed in its object and at the same time had been prevented from fulfilling any other function than defence against night bombing—and this had very grave consequences for the strategy of the German Air Force as a whole. That state of affairs was achieved by a constant use of the latest scientific devices, but the use of sound tactics and, above all, by the courage and skill of the bomber crews who were always ready to engage a faster, more manœuvrable and more powerfully armed fighter aircraft when the enemy did succeed in making contact.

At the beginning of the war, in 1939 and 1940, Germany had no night fighter force. The defence of Germany, against a bomber force which the enemy knew to be weak, was entrusted to anti-aircraft guns and searchlights. This was reasonable on the hypothesis that Germany would expect to win the war outright long before the Allies in the West could build up any considerable bomber force. In the early summer of 1941, when the Battle of Britain had deprived Germany of the hope of final conquest in the West and the invasion of Russia was projected, some better defence had to be organised against the increasing threat of bombing from bases in England. A force of some 250 Messerschmitt 110s was formed. As with almost all German night fighters, and all German twin-engined night fighters, these were modified bombers, but at that time a rather unsuccessful type of bomber was chosen; later it became necessary to convert to night fighting more successful types of bomber, the Junkers 88 and the Dornier 217.

So began a course of action which profoundly modified the whole strategy of the *Luftwaffe*. At this time, in June, 1941, Germany had a force of 1,500 bombers, largely designed for co-operation with the German army, though used in the previous winter to bomb London and other British towns. The next year, in June of 1942, the enemy still had a force of 1,500 bombers. By June, 1943, however, the enemy's twin-engined fighter force had risen to 530, and there was a corresponding decrease in bomber strength, which stood at 1,300 aircraft. By September of 1944 the enemy's strength in night fighters and bombers was roughly equal, about 800 of each. But in actual production of aircraft there had been a much greater shift than the figures would suggest from bomber production to night fighter production. Bomber strength remained at a high figure because the aircraft were seldom used in operations after 1942, and the front line strength was maintained by a policy of conservation.

Night Bombers Defeat Bombers

It is a paradox of the war that the night bombing of Germany defeated the German bomber force even before the enemy's aircraft industries had been reduced by air attack. The strategic importance of the German army's loss of all bomber support can hardly be exaggerated; the weapon which made the *blitzkrieg* possible, from 1939 to 1941, was struck from the enemy's hands. The enemy would have been fully justified in exchanging an offensive for a defensive weapon if this had in fact made the night bombing of Germany impossible. And at first it must have seemed to the enemy that he had a fair chance of succeeding in the policy of attrition against Bomber Command. In 1941 Bomber Command's casualty rate was 2.5 per cent. of all sorties; in 1942 it had risen to 4 per cent., and the night fighter strength was due to be more than doubled by 1943.

During 1943 the great expansion of Bomber Command's force was to occur, but if the night fighters could shoot down a larger percentage, and not a very much larger one, than in 1942, the result would be either that the expansion would never occur or that operations against German industry would have to be infrequently carried out. Two to three hundred four-engined bombers were being produced every month, and if 40 bombers could be destroyed in each major operation, and if there were to be six major operations a month, any great access of strength would be unlikely. Such a result was by no means improbable; the Battle of the

Air Chief Marshal Sir Arthur Travers Harris, A.O.C.-in-C. Bomber Command.

BOMBER COMMAND'S OFFENSIVE

Ruhr, from March, 1943, onwards, was not fought without heavy casualties, and the German night fighter force was becoming not only stronger but more efficient.

Time/Space Concentration

From 1941 onwards a great number of stations had been built up throughout Germany to control the night fighters, and the enemy had also an efficient early warning system. With experience, co-operation between the night fighters and these ground stations became more and more effective. The first answer to this system was to concentrate the bombers in time and space during their journey to and from the target. This difficult navigational feat became increasingly easy as navigational aids were developed. Such concentration meant that at any one time only one or two ground control stations linked to a comparatively small number of fighters had the bomber stream within range. On the whole, increased concentration along the route balanced the increased efficiency of the German defensive system; the casualty rate in 1943 fell from 4 per cent. to 3.7 per cent. This rate is for the whole year. On the first night of the Battle of Hamburg, on the night of July 24th-25th, the casualty rate, for instance, was only 1.4 per cent.

After this battle the enemy's first reaction was to send the fighters to intercept the bombers over the target instead of to attack them whenever they were within range of the ground control stations. A single-engined night fighter force, with a strength of about 350 aircraft, was also developed to intercept the bombers over the target. With this new system, aircraft of shorter range than the twin-engined fighters had a chance of intercepting. But there was always an inevitable lapse of time before the fighters reached the target that was being bombed, and the bombers were comparatively immune from attack during the first quarter of an hour or twenty minutes. Then the fighters began to arrive in large numbers.

CASUALTY RATE

1941	.. ..	***2.5 per cent.***
1942	.. ..	***4.0 per cent.***
1943	.. ..	***3.7 per cent.***
1944	.. ..	***2.2 per cent.***

Highest casualty rate in any one raid, 12.0 per cent. (96 aircraft lost out of 800 attacking Nuremburg on night of March 30th, 1944.)

Bomber Command's reply was to increase the concentration of the bombers, both in time and space. Instead of the bombers coming over the target at a rate of about 800 an hour, they now attacked at a rate of about 1,800 an hour, and were generally on the homeward run before the fighters arrived. None took longer than 15-20 minutes and, to make doubly sure, feint attacks were carried out, and at the same time the bombers were so routed as to suggest to the enemy that they were approaching a target which, however, they did not bomb.

When the enemy found that he could seldom get his fighters to the bombers' target in time, he improved his methods of plotting the course of the bomber stream overland and aimed to get the fighters into the stream as soon as possible after the bombers had made landfall. The fighters were then to keep in the stream all the way to the target and back again to the coast, making as many interceptions as possible. This plan was very dependent on the efficiency of the early warning system and on basing the fighters over a wide area so that they could converge from all directions on the bomber stream.

It proved an uncertain method, but if the fighters did succeed in getting into the stream, and if the weather or other conditions were suitable for interception, more bombers were shot down on these few occasions than in any single night before. Casualties were very heavy on certain operations, though the overall casualty rate did not increase. The heaviest loss of all was on the night of March 30th, 1944, when 96 aircraft were missing out of a force of about 800 attacking Nuremburg, but only nine were missing out of a force of more than 700 attacking Essen on the night of March 26th, 1944.

Britain's output of four-engined heavy bombers was 200/300 per month.

Vigorous measures were at once put in hand to oppose these new tactics. Experienced Mosquito night-fighter crews, originally trained to operated with Fighter Command over Germany against enemy bombers flying to attack this country, flew with the bomber stream and shot down or chased away the night fighters. The number of feint attacks was also increased and by the time the Germans discovered which were the genuine targets it was usually too late to send the fighters to the real bomber stream. The bombers engaged in these feint attacks were widely dispersed in space and could take incessant and complicated evasive action. Because of this their casualties were light, even when they had the greater part of the enemy's night fighter force flying with them and after them. The tactics of putting the night fighters into the bomber stream was the enemy's last serious attempt to defeat the night bombers by attrition. Henceforth the night bombers always kept the upper hand.

Bomber Command flew 100,000 sorties by night during 1944, and losses were only 2.2 per cent. This marked improvement over 1943 was largely due to ingenious tactics and scientific devices, but the arrival of the Allied armies on the German frontier in the early autumn was another very serious blow to the enemy's early warning system. Furthermore, there were other advantages to be gained from "mass" as opposed to formation flying. Anti-aircraft fire is less effective against bombers flying in a stream. Another advantage is that bombing by aircraft in a stream is far more accurate and concentrated than bombing by aircraft in formation.

Daylight Attacks

The complete air superiority gained for the landings in France also enabled Bomber Command to operate in great strength by day. Although the loose stream of night bombers was not easy for fighters to protect in daylight—Bomber Command's crews had never been trained to fly in formation and their aircraft were necessarily dispersed over a wider area than the heavy bombers of the U.S.A.A.F.—there was now little chance of the enemy's day fighters risking combat unless the bombers went far into Germany and beyond the range in which Allied air superiority was absolute. As the Allied armies advanced, Bomber Command was able to make daylight attacks deeper into Germany, but all really long-range attacks were made by Bomber Command in darkness.

By 1941, as has been said, the Germans recognised that the anti-aircraft gun could not be their main defence against aircraft flying high and by night. But this does not mean that flak was not, at all times, a serious danger

Germany kept a force of 800 night fighters throughout most of the war, to ward off attacks by Bomber Command.

to the bomber crews, or that the enemy ever ceased to protect his industrial cities and other targets with great numbers of guns. Even when these were urgently needed by the army. The great majority of German A.A. guns were dual-purpose weapons which could be used against tanks or as field guns as well as against aircraft, and to keep these guns from the army was a serious blow for the enemy. In 1943 75 per cent. of all the enemy's heavy A.A. guns, mainly the 88 mm. gun, a most efficient anti-tank weapon, were engaged on the Western Front in air defence.

Losses from enemy flak, however, during the main bomber offensive of 1943 onwards, were never heavy enough to affect the issue of the war of attrition between the night bomber and the German defences. Anti-aircraft fire accounted for a high proportion of the casualties only during the first two years of the war, when Bomber Command was inadequately equipped. Thus during 1942 losses from fighters and *flak* were about equal, though the fighters were probably already causing a few more casualties than the A.A. guns. But in 1943, 75 per cent. of Bomber Command's losses were from fighters and 25 per cent. from guns.

GERMAN FLAK

In 1943, 75 per cent. of all enemy heavy A.A. guns were on air defence on the Western Front.

From 1942 onwards, concentration in time and space did much to reduce casualties from *flak*. A gun can only engage one aircraft at a time, and the more bombers overhead at any given moment, the smaller the proportion of the total force that can be hit. Shooting into the "crown" of the concentration is never effective, but this method of defence was forced upon the enemy because the concentration of aircraft made it impossible for the enemy to pick out a single aircraft for attack.

Intricate Campaign

It will be seen that air supremacy for the bomber by night is a very different thing from air supremacy by day, but both were equally vital to the defeat of Germany. Each of Bomber Command's engagements in a prolonged and intricate campaign, the issue of which often hung in the balance, had to be won if night bombing was to prepare the way for the landings on the Continent, save our armies from the heavy casualties of the last war and give continuous support at every stage of the land offensive until the defeat of Germany. Nor should the effect of night bombing on the Russian front be overlooked. Apart from the effect on this front of the destruction of large industrial areas in Germany, and the direct support given to the Russian army by the bombing of Saxony in 1945, it was on the Russian front that the effect of depriving the German army of bomber support first showed itself. This was the direct result of the enemy's switch from bomber to night fighter production.

With air superiority by night the tactical problems of night bombing were very far from exhausted. It may now be said that in 1940 there was cause for grave anxiety about the results of our night attacks. Only the most experienced crews were then able to find the target in darkness and a bomber force, as was projected, of more than a thousand aircraft, could not be entirely manned by men of exceptional ability and years of experience. As soon as the facts were fully understood, after a careful analysis of photographs taken from the aircraft during bombing, British science provided the answer.

The first navigational aid used by the R.A.F. was, in fact, already in existence before the war, though the application of it to night bombing had not been then considered. Throughout 1941 the work of experiment and training went on, and by the spring of 1942 Bomber Command was ready to solve the problem of really accurate bombing of large industrial areas by night, by large numbers of aircraft and against heavy defences.

It so happened that the answer to the problem of finding the target was also the main answer to the enemy defences. Unless the navigator could tell where he was within a mile or so in relation to the target at any moment of the flight, and could therefore see that the speed of the aircraft was adjusted to a precise time-table, it was impossible to achieve concentration of aircraft in time and space. And so the same device which allowed the navigator to find the target on a dark night, made possible the planned and concentrated attack which, because of the growing strength of the night fighter force, had become essential by 1942.

The first attack of the war to be planned minute by minute in this fashion was carried out just before the general use of navigational aids. This was the attack on the Renault works on the night of March 3, 1942. It was far more rapid than any previous attack of equal weight, and every stage of the flight of every aircraft was planned and timed in advance. It was also the first obviously successful large-scale attack by night. But here a brilliant moon was the navigational aid, and it was one thing to operate over France and another to operate against all the German defences in such weather.

The first large-scale attack with navigational aids was made a month later, against the port and U-boat centre of Lubeck, and the efficiency of the new methods was proved when the first German industrial centre went up in flames. For the concentration in time and space which navigational aids made possible in all weathers, which was necessary if all crews were to reach the target during the period when picked crews had made it visible by flares and fires, and which was essential as a protection against night fighter attacks, was also the answer to the passive defence of targets in Germany. The fire brigades were completely powerless when enormous numbers of fire bombs were dropped within as short a time as half an hour. Seldom can a scientific invention have had a more profound effect on tactical development, and indeed, on the whole strategy of the war. These new tactics were developed at a time when the only conceivable offensive action against Germany in the West was to bomb the enemy's war industries.

The thousand-bomber attack against Cologne was a test, on an even larger scale, of the new tactics which navigational aids made possible. And it would, in fact, have been impossible to despatch a force of this size without these aids. A force of 1,000 bombers could not have been handled at all unless the route and timing of each single aircraft could be arranged to the mile and the minute according to a predetermined plan. No other air force in the world could, at that time, have used anything like so large a force in a single operation.

(To be continued.)

BOOK REVIEW

Aircraft Armament. By Louis Bruchiss. Aerosphere Inc.

FROM time to time *Flight* has felt reluctantly compelled to protest against American publications in which credit for some new development has been given wholly to the U.S. when in truth a large share of it should have been given to British efforts. No such charge, we are happy to state, can be levelled against the author of *Aircraft Armament*.

This book, which is the first to cover aircraft ordnance in all its phases, ranges from the light Lewis and Browning machine guns of the 1914-18 war to the latest types of weapons in use to-day. Anti-aircraft weapons, including the rocket batteries used against enemy raiders in Britain, and various examples of self-propelled bombs up to the German V1 flying bomb are also studied, the volume being generously illustrated with diagrams, sketches and photographs, including some from *Flight*. And in reference to the section dealing with jet and rocket propulsion full acknowledgment is given in the author's preface to the help given him by Mr. Geoffrey Smith, managing editor of *Flight* and *Aircraft Production*.

The chapter on "Future Aircraft Weapons and Air Warfare" is notable for its sober common sense, for while indicating some of the possible developments indicated by advances made in World War II, it discounts suggestions that another war in the next generation would see air staffs pressing buttons to actuate and control robot bombing fleets.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

NEW FIFTH SEA LORD

An Ambiguity Removed

AN ambiguously worded phrase in the notice which I contributed to *Flight*, May 3rd, 1945, may have been erroneously interpreted as implying that Vice-Admiral Boyd—the late Fifth Sea Lord—was not air-minded.

Of course, his brilliant record both at sea and in high Admiralty office shows him to have been, and still to be, one of the most progressive and urgently air-minded of all the senior officers connected with naval aviation, and I therefore hasten to correct any phrasing which might have given a contrary impression when read out of context. B. J. HURREN.

NATIONAL AIR MUSEUM

Difficulties that should be Considered

I SUGGEST that this matter requires very careful consideration before any decision be made, and I venture to suggest a few difficulties:—

(*a*) Is it desirable to multiply museums? The subject is covered at present, more or less adequately, by the Science Museum in regard to technical development, and by the Imperial War Museum for the record of operational achievement in the last and the present war.

(*b*) Assuming a new museum be desirable, surely the only possible site would be in central London, where it would be easily accessible to the maximum number of visitors.

(*c*) The practical objection to showing all types of actual aircraft, rather than models, is that no building smaller than the old Crystal Palace would be adequate, and to find space for this, subject to (*b*), would be almost out of the question, apart from the colossal expenditure involved. "REALIST."

AIRCRAFT NOISE

An Earsplitting "Harvard" Roar

AS a regular reader of many years' standing of your highly esteemed publication, I would consider it a great favour if any of your readers could give an explanation for the following.

An aircraft resembling a North American "Harvard" trainer is flying along at a reasonable altitude in level flight, when suddenly, and for no apparent reason, the speed appears to drop slightly and simultaneously the engine gives a really earsplitting roar. There is no change in the aircraft's progress, the flight continuing before, during and after this roar in a perfectly normal fashion.

This earsplitting roar occurs at intervals during the time the aircraft is in the air, and as there is generally a considerable number in the air together, the resultant din has to be heard to be fully appreciated, and is nerve-racking, especially for people advanced in years.

If the noise is necessary, no one could reasonably take exception to it, but if it is simply a "stunt" on the part of the pilot it would be better for the local population if it were to cease forthwith, as at present there is no respite day or night.
W. R. CAMPBELL.

MAN-POWER AND CIVIL AVIATION

An Enthusiastic Technician's Experience

YOUR leading article, "Man-power and Civil Aviation," in *Flight*, May 31st, has prompted me to write to you as I thought you might be interested to hear another point of view—that of the technician (if I am not overrating myself).

I have had 8¼ years' experience in the aircraft industry (not long, I admit, when one thinks of the "old sweats," but long enough to cover "the" types of to-day, *i.e.*, metal).

My experience covers production, repair and overhaul, D.T.D. experimental and flight test, as charge-hand, foreman, senior foreman and superintendent.

My varied experience in the industry has been due to an enthusiastic desire to "gen up"; the positions I have held came my way more or less automatically owing to the knowledge obtained so enthusiastically, not through any particular ambitious desire. (I say this because I know a few ambitious types in the industry who have the position but technically they "haven't a clue.") The point I want to press home is that my heart and soul is in aircraft

A few months ago the contract I was on—the repair and overhaul of front-line aircraft—was completed and, the company concerned not having any further interest in aircraft, I became unemployed. I registered with the Ministry of Labour Appointments Board, mentioning I was prepared to consider any position which might be available in the aircraft industry. I have also contacted many well-known companies in the industry through the usual channels, and the reply is usually "We have no position to offer a man with your qualifications, etc., etc.,"

However, when I saw the M.A.P. advertisement in your columns (and bearing in mind that I had been on M.A.P. contracts for over six years) I thought "Just up my street!" and not wishing to be too ambitious I applied for the "lesser" position of Technical Officer. After submitting my application I set to and started to sort out all the points the designer always (or nearly always, ahem!) seems to miss—points from the pilot's angle. I have come in contact with quite a number of well-known test pilots during the course of my duties and, without exception, they have all passed such remarks as "Why the hell have they put it there?" or "If I had three hands I'd be okay in this cockpit!" and so on.

As for my own experience, I have come across a considerable amount of design points that could do with modification when it comes to maintenance and handling of the aircraft. But I'm afraid I was a bit too presumptuous, as yesterday I received the "We regret to inform you . . ."

So much for the position of Technical Officer; maybe M.A.P. had a preview of your "Outlook" column?

So much from my point of view; I suppose eventually I'll be *directed* to some job about which *I* haven't a "clue."
R. L. HUGHES.

FLYING-BOAT MOORINGS

A Point About Seaplane Floats

I WAS glad to see Mr. Oswald Short's letter in *Flight*, June 7th, in which he gave further interesting information concerning his own and his brother Eustace's work in improving flying-boat moorings, and in which he made a kindly reference to myself. He will, I am sure, however, permit me to correct him on one small point when he writes that I made my first flight to Greenland "with a de Havilland Moth fitted with Short all-metal floats to convert it into a seaplane. . . ."

Actually, when I made my first attempt at flying the Arctic Air Route in 1933 I used my old Gipsy Moth, *Rouge et Noir*, converted to seaplane with a second-hand pair of Blackburn Bluebird floats. These were very sturdy floats, and although perhaps they did not appear as smooth and streamlined as the Short type, their adverse effect on performance was a good deal less than expected. The top speed was 97 m.p.h.; I reached a ceiling of 12,000ft., and took off with 70 galls. of fuel plus a lot of wireless and emergency gear. The cruising speed of 75 m.p.h. was above the estimate of Mr. R. M. Clarkson, de Havilland's chief aerodynamicist.

In 1934 I *did* use Short floats on my second and successful attempt to reach Ottawa—this time with a de Havilland Fox Moth. Now my cruising speed rose to 90 m.p.h., and I was able to cross the Greenland Ice Cap (which runs up to nearly 10,000ft.) in a flight of 317 miles at between 10,000 and 12,000ft. At the same time another Fox Moth, equipped with Canadian floats, was being flown by Flt. Lt. W. E. Hampton in the Antarctic. The reason for using Canadian floats was that these were much more rugged than the standard Short product, and they would stand up to battering amongst snow and ice much better. On the other hand, Hampton's cruising performance was down on mine and he found climbing to 10,000ft. only just possible with reduced load.

The moral of all this is that if we are going to sell seaplane floats abroad we must send out something a bit more resistant to abuse than the article which meets the very gentile requirements of seaplane operations around these shores. In America and Canada many people admired the sleek appearance of my Short floats—they are probably the best of any in the world aerodynamically and for lightness, but observed that they would never stand up to conditions in those countries. Therefore, if we want the foreign markets, let us retain the British characteristics of cleanness, but concede a little weight in order to attain the sturdiness necessary for operating under the conditions pervailing overseas. JOHN GRIERSON.

MARINE AIR SERVICE? : An Auster of the Royal Artillery lands on a British aircraft carrier during the assault on Rangoon.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Appointments

THE Air Ministry announces the following R.A.F. appointments:—

Air Vice-Marshal Charles Roderick CARR, C.B., C.B.E., D.F.C., A.F.C., to be Deputy Chief of Staff (Air), Supreme Headquarters, Allied Expeditionary Force (Air), Main, and to be acting Air Marshal.

Air Vice-Marshal Gerald Ernest GIBBS, C.B.E., M.C., to be Deputy Chief of Staff (Air), Supreme Allied Commander of South East Asia.

Air Vice-Marshal Noel Lloyd DESOER, to be Senior Air Staff Officer, H.Q., R.A.F., Burma.

Air Commodore Cecil Arthur BOUCHIER, C.B.E., D.F.C., to be Air Officer commanding a group in Air Command, South East Asia, and to be Acting Air Vice-Marshal.

Air Marshal Carr has been a Senior Air Staff Officer at Headquarters, Bomber Command, since February, 1945. He was for nearly four years previously Air Officer commanding No. 4 Group, and in 1940 was Air Officer commanding, headquarters, Northern Ireland.

He is a New Zealander and enlisted in the Royal Naval Air Service in 1915, transferring to the R.A.F. three years later. In 1919 he served with the R.A.F. in North Russia, receiving the D.F.C. for his services.

He received the A.F.C. in 1928 for his share in the attempts on the world's long-distance record, flying a special Hawker Horsley aircraft.

Air Vice-Marshal G. E. Gibbs has been Air Officer Commanding a group in Air Command, South East Asia, since April, 1945. He was formerly Senior Air Staff Officer at R.A.F. Headquarters, Bengal, and at the Headquarters of 3rd T.A.F., Air Command, South East Asia.

He enlisted in the Army a few days after the outbreak of the last war, gaining a commission in 1915. The following year he obtained a transfer to the Royal Flying Corps and was posted to the Middle East. It was there that he gained the M.C. and two Bars.

In 1920 he studied at the R.A.F. Cadet College, Cranwell, and the School of Naval Co-operation and Air Navigation, and later took a staff course at the R.A.F. Staff College. In 1936 he became Deputy Director of Equipment and then S.A.S.O. No. 11 Group for nearly two years, and in 1942 was appointed Director of Overseas Operations.

Air Vice-Marshal Desoer has been Air Officer Commanding a group in Air Command, South East Asia, since September, 1944. He was previously Deputy Senior Air Staff Officer at Headquarters, Air Command, South East Asia, and Air Headquarters, India. He enlisted in the R.F.C. as air mechanic (3rd Class) in 1917, and was commissioned in the same year.

After serving in France on flying duties, and at various home establishments he went to the Middle East in 1920.

In 1934 he was Secretary of the Aerodrome Board at the Air Ministry, and in the following year was given command of No. 2 Squadron. In 1938 he passed the Army Staff College at Camberley.

Air Vice-Marshal Bouchier has been Senior Air Staff Officer at Headquarters, Fighter Command, since June, 1943. He was previously Deputy Director of Fighter operations at the Air Ministry, and in 1941 commanded the R.A.F. station at Kenley.

In 1922 he served on flying duties at the experimental section, Royal Aircraft Establishment, remaining for four years before going to No. 43 Squadron. Later he went to Headquarters, No. 11 Group, on air staff duties, and from December, 1939, to December, 1940, during the Battle of Britain commanded the Fighter Station at Hornchurch.

Awards

THE KING has approved the following awards in recognition of gallantry and devotion to duty in the execution of air operations.

Distinguished Service Order

Lt. Col. D. D. MOODIE, D.F.C., S.A.A.F.—This officer has given extremely gallant and distinguished service in close support operations. On March 7th, 1945, he led a formation of aircraft to attack an important target, consisting of a building in close proximity to forward elements of our ground forces and situated in rugged and broken terrain. Despite heavy anti-aircraft opposition, the attack was perfectly timed and pressed home with exceptional success. The target was effectively bombed, six hits being observed. This instance is only one of several outstanding missions led by Lt. Col. Moodie. On several occasions he has led similar sorties with excellent results. He is at present engaged on his third tour of operations and has destroyed at least one enemy aircraft and damaged others.

Act. Sqn. Ldr. C. P. C. DE WESSELOW, D.F.C., R.A.F.V.R., No. 635 Sqn.—This officer has set a fine example of courage and devotion to duty. He has completed a very large number of sorties, involving attacks on targets important to the enemy's war effort. Undeterred by the heaviest opposition, Sqn. Ldr. de Wesselow has invariably pressed home his attacks. His successes are a fine tribute to his great skill and iron determination.

P/O. R. M. PERKINS, R.A.F.V.R., No. 180 Sqn.—This officer and Flt. Sgt. Hall were pilot and air gunner respectively in an aircraft detailed to attack the railway yards at Bocholt in March, 1945. During the bombing run the aircraft was hit by fire from the ground defences. P/O. Perkins was severely wounded. His right thigh was smashed; he also sustained injuries to his back. His suffering became intense. Nevertheless, this brave pilot, tended by Flt. Sgt. Hall who stood at his side, flew the aircraft to an allied airfield. As the airfield was reached P/O. Perkins was in great distress. Although the aircraft had sustained serious damage it was decided to attempt a landing. Flt. Sgt. Hall assisted to remove his wounded comrade into the second pilot's seat and then himself took over the controls in an effort to bring the aircraft down. During the descent, P/O Perkins, injured as he was, advised and directed his resolute air gunner in the control of the aircraft so well that a successful crash-landing was effected. P/O. Perkins displayed outstanding fortitude, great courage and unbeatable determination in the face of extreme suffering. Flt. Sgt. Hall also proved himself to be a valiant crew member. His coolness, courage and resource set a fine example.

Act. Sqn. Ldr. D. O. SANDS, D.F.C., R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.—This officer has completed many sorties on his second tour of operational duty. Throughout these operations, most of which have been against strongly defended targets, Sqn. Ldr. Sands has displayed the highest standard of determination and devotion to duty. By his undoubted ability as navigator and his efficiency as captain, this officer has played a good part in the successes obtained. His services have been invaluable.

Bar to Distinguished Flying Cross

Act. Wing Cdr. R. A. MILWARD, D.F.C., R.A.F. No. 619 Sqn.—Since the award of the D.F.C. this officer has completed his second tour of operational duties. During this tour he has completed attacks on tactical targets in the battle areas of France and Germany and has also attacked Trondheim and Munich. As a squadron commander he has displayed a high standard of operational efficiency which has set a fine example to all those serving under him. His courage and devotion to duty have been highly praiseworthy at all times.

Act. Sqn. Ldr. J. D. G. BISHOP, D.F.C., R.A.F.V.R., No. 105 Sqn.—Sqn. Ldr. Bishop has completed a large number of operational sorties in the course of which he has shown outstanding skill and determination. He has fulfilled most important duties on many occasions and has, since the award of the D.F.C., fully maintained his previous standard of courage and tenacity in many attacks on heavily defended industrial targets in enemy territory.

Act. Sqn. Ldr. J. V. COCKSHOTT, D.F.C., R.A.F.V.R., No. 617 Sqn.—Since the award of the D.F.C. this officer has completed many operational

SERVICE AVIATION

sorties against highly defended enemy targets, including attacks against the battleship Tirpitz and the Kembs Barrage. His aircraft was one of a small force of six detailed to attack the Kembs Barrage at low level. Enemy opposition was most intense. Despite this, Sqn. Ldr. Cockshott made a perfectly steady bombing run. The determined and courageous manner in which he pressed home his attack played an important part in the breaching of the Barrage and the subsequent disruption of the enemy land forces in that area. His outstanding skill and devotion to duty at all times have been most commendable.

Distinguished Flying Cross

Act. Flt. Lt. J. D. MATTHEWS, R.A.A.F., No. 578 Sqn.
Act. Flt. Lt. T. A. PERRY, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
Act. Flt. Lt. J. D. SLEEMAN, R.A.A.F., No. 15 Sqn.
F/O. J. B. MCMANUS, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Flt. Lt. B. FORD, R.A.F.V.R., No. 192 Sqn.
F/O. D. J. COATES, R.A.F.V.R., No. 192 Sqn.
Flt. Lt. G. M. HOWARD-JONES, R.A.F., No. 180 Sqn.
Flt. Lt. O. C. MUNDIN, R.A.F.V.R., No. 640 Sqn.
Act. Flt. Lt. G. G. H. COWPER, R.A.F.V.R., No. 550 Sqn.
F/O. R. C. KENDALL, R.A.F.V.R., No. 239 Sqn.
Act. F/O. G. E. DARVILLE, R.A.A.F., No. 622 Sqn.
Act. F/O. T. DUTTON, R.A.F.V.R., No. 192 Sqn.
W/O. F. COULTON, R.A.F.V.R., No. 192 Sqn.

Conspicuous Gallantry Medal (Flying)

Act. Flt. Sgt. T. W. D. KELLY, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. J. M. HALL, R.A.F., No. 180 Sqn. (For citation see P/O. R. M. Perkins, D.S.O.)

Flt. Sgt. J. RETTANY, RA.F.V.R., No. 625 Sqn.—This airman was the wireless operator in an air craft detailed to attack Pforzheim one night in February, 1945. Soon after the target had been bombed the aircraft sustained serious damage. Several small fires commenced, but Flt. Sgt. Bettany, displaying great promptitude and bravery, dealt with most of them effectively. Some few minutes later one of the starboard tanks exploded and set the starboard outer engine on fire. The pilot gave the order to abandon the aircraft. The intercommunication system was out of action, so he requested Flt. Sgt. Bettany to give the message verbally to the mid-upper and rear gunners. As he made his way along the fuselage, this airman's parachute caught on some wreckage and opened. Undaunted, Flt. Sgt. Bettany completed his errand and ensured that his comrades were clear before he himself donned the spare parachute and jumped. His coolness, bravery and resolution in a critical situation set an example of the highest standard.

Distinguished Flying Medal

Flt. Sgt (now P/O.) J. S. MORRELL, R.A.F.V.R., No. 692 Sqn.
Flt. Sgt. E. G. OSTIME, R.A.F.V.R., No 635 Sqn.
Flt. Sgt. R. J. H. PERRY, R.A.F.V.R., No. 166 Sqn.
Flt. Sgt. W. J. PHILLIPS, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. F. H. POLDEN, R.A.F.V.R., No. 51 Sqn.
Flt. Sgt. F. N. POYNTER, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. G. PRATT, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. A. R. HALL, R.A.F.V.R., No. 635 Sqn.
Flt. Sgt. C. B. JOLLIFFE, R.A.F.V.R., No. 7 Sqn. (since deceased).
Sgt. J. D. BRINKHURST, No. 104 Sqn. (since deceased).

Roll of Honour

Casualty Communiqué No. 516.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of these, 192 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—P/O. J. B. Breare; Flt. Sgt. G. H. Hillman; Flt. Lt. W. J. L. S. Lowes, D.F.C.; Sgt. F. Smith; Sgt. J. Squire; Flt. Sgt. R. J. F. Swain.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. A. Bond; W/O. S. E. Boxall; Sgt. D. S. Bruty; Flt. Sgt. R. Coates; Sgt. K. Dickinson; P/O. P. J. Dukelow; F/O. L. R. Dunham; F/O. J. D. Hegarty; Flt. Sgt. J. H. Myers; W/O. P. J. Thomas; F/O. R. F. Wilcock.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. A. Applegate; Sgt. A. L. A. Ash-Smith; Sgt. E. J. Atkinson; P/O. R. F. Ayres; Sgt. R. C. Barber; F/O. S. P. Barter; Flt. Sgt. J. E. Bloomer; Sgt. P. V. Boyter; Sgt. P. C. Brown; Flt. Sgt. N. Butcher; Sgt. I. Campbell; Sgt. S. K. Chalklin; Sgt. W. S. Chapman; Flt. Sgt. A. J. A. Chappel; Sgt. A. B. Chester; Sgt. R. Clegg; Flt. Lt. W. M. Conlon, D.F.C.; F/O. F. W. Cosens, D.F.C.; F/O. A. J. Crouch, D.F.M.; F/O. C. D. Croxford; Sgt. W. P. Cullen; Sgt. F. K. Dench; Flt. Sgt. L. H. Dunlop; Sgt. R. Eddison; Sgt. R. Edgeworth; F/O. C. J. Elmer; F/O. C. E. Esam; Sgt. D. E. Fabb; F/O. E. W. W. Feldon; Sgt. M. F. Fenton; Sgt. L. A. Field; Sgt. F. Fitzsimmons; Sgt. V. B. Foy; Sgt. P. J. Gallacher; Sgt. C. C. A. Gardner; Flt. Sgt. J. Gomersall; Sgt. A. W. Gowland; Sgt. J. K. Gray; Sgt. E. R. Groves; Flt. Sgt. J. Hague; Sgt. T. J. Hall; Sgt. F. M. C. H. Harris; Sgt. S. Hartley; Sgt. E. J. Hayler; Flt Sgt. E. T. Helps; F/O. W. R. Henderson; Sgt. C. Higgins; Sgt. E. P. Hillyard; F/O. J. H. Hood; Sgt. W. C. Jack; Sgt. S. A. Jarvis; Sgt. S. D. Jeavons; Sgt. R. Johnson; Sgt. D. Jones; Sgt. S. L. Jones; F/O. D. F. W. Keyte; Sgt. J. J. King; Sgt. T. Kirby; W/O. A. R. P. Larkins; Sgt. J. J. Leishman; F/O. A. Lewis; Flt. Sgt. J. H. B. Lister; P/O. M. J. Litchfield; Sgt. D. Lloyd; Sgt. J. P. McCormick; Flt. Lt. W. J. A. Mackay; Flt. Sgt. J. J. McKeown; F/O. W. R. McNaughton; Flt. Sgt. J. Macpherson; Flt. Sgt. J. C. W. Marshall; Flt. Lt. A. D. May; Sgt. D. A. W. Mayo; Flt. Sgt. W. P. Mead; Sgt. C. S. Menzies; Sgt. E. W. Mickleborough-Saunders; Flt. Lt. I. S. Miller; Sgt. A. W. Mitton; Sgt. E. H. J. Morgan; F/O. J. Newcombe; Sgt. D. D. Orme; Sgt. J. Palmer; Flt. Sgt. E. H. Parsey; Sgt. H. J. Plant; Flt. Sgt. J. G. Pollard; Sgt. H. J. Prouten; Flt. Sgt. T. H. Redgate; Flt. Sgt. A. W. Reedman; F/O. W. J. Rice; Sgt. R. Richardson; P/O. W. E. Robinson; Sgt. J. Sagar; Sgt. J. W. Scholey; F/O. F. N. Scott; Sqn. Ldr. N. L. Shove, D.F.C.; Flt. Sgt. E. B. Smith; Sgt. T. J. Stanley; F/O. H. M. Steward; F/O. C. H. Stewart, D.F.C.; F/O. D. W. Stewart; Flt. Sgt. G. R. Stewart; Sgt. A. Supkovitch; Sgt. E. G. Swallow; Flt. Sgt. H. S. Tait; F/O. W. J. Tay; Flt. Sgt. J. Taylor; P/O. R. W. Theobald; F/O. R. Tibbs; Sgt. J. D. Topple; Flt. Sgt. P. Traynor; Flt. Sgt. D. O. Tunbridge; Sgt. P. A. Turner; Sgt. E. B. Upton; Sgt. W. C. Vessey; F/O. E. L. Walker; Sgt. S. Wasson; Sgt. C. R. West; Wing Cdr. V. J. Wheeler, M.C., D.F.C.; Sgt. E. White; Flt. Sgt. R. White; Sgt. W. R. Williams; Flt. Sgt. A. Wragg; Sgt. D. J. Young.

WOUNDED OR INJURED IN ACTION.—W/O. J. R. Clarke.

MISSING, BELIEVED KILLED IN ACTION.—W/O. R. MacKenzie; Flt Sgt. C. F. Nichol; F/O. R. L. Rees.

MISSING.—Sgt. J. Allman; Flt. Sgt. T. E. Anthony; Sgt. G. Arnold; F/O. G. R. P. Blackbourn; F/O. L. Blick; Sgt. E. A. Bradshaw; Flt. Lt. K. H. Brailsford; Sgt. D. P. Burns; Sgt. D. H. Clayton; Sgt. L. Cornbloom; Sgt. J. D. Craig; Sgt. G. Diffey; Sqn. Ldr. R. S. Don; Sgt. D. A. Dorey; F/O. R. B. A. Dukelow; Sgt. R. Evans; Sgt. D. B. George; Sgt. J. G. Gibbs; Sgt. C. W. Gordon; Flt. Lt. J. B. Gordon; Sgt. J. Gough; Sgt. W. W. Hammond; F/O. D. Hargreaves; Sgt. W. F. Hart; Flt. Sgt. J. R. Hartshorn; Sgt. J. R. Hasson; Sgt. E. C. Hemmant; Flt. Lt. R. W. Henderson, D.F.C.; Flt Lt. V. W. Hodnett; Sgt. J. W. Holmes; F/O. R. A. Horne; F/O. R. Howarth; F/O. P. G. Hughesdon; Flt. Sgt. D. I. Humphrey; Flt. Sgt. N. G. Jones; W/O. W. Lear; F/O. J. S. E. Locock; Sgt. B. C. Long; Sgt. J. E. Look; Sgt. D. J. Mackay; W/O. J. W. McStay; Sgt. A. T. A. Marden; F/O. A. G. Martin; Sgt. T. F. Morgan; Sgt. T. O'Gorman; W/O. G. A. O'Toole; Sgt. J. Pannett; F/O. R. Poole; Sgt. A. J. Rabin; Flt. Lt. D. A. Sheppard; Sgt. J. Sherry; Sgt. J. W. Slaughter; F/O. D. M. Smithers; Flt. Sgt. R. D. Story; Sqn Ldr. I. D. S. Strachan; Flt. Lt. G. B. Strang; W/O. J. B. Swain; Flt. Lt. E. H. A. Vernon-Jarvis, D.F.C.; W/O. E. H. Wheatley; Sgt. H. Whiteley; Flt. Sgt. S. Willis; Sgt. J. A. Wilson; F/O. R. J. Wilson; F/O. W. H. Wilson; F/O. K. W. Winder.

KILLED ON ACTIVE SERVICE.—Sgt. R. Devlin; F/O. H. H. Freedman; F/O. W. E. Fuller; W/O. J. Hesketh; F/O. D. Jackson; Sgt. G. R. Lake; Sgt. F. A. Poole; Sgt. L. R. Wilkins.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. Greaves; Flt. Lt. L. V. Walter.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. M. R. Bonser; Flt. Sgt. E. A. Durrant; Sgt. H. W. Fricker; Sgt. J. T. H. Johnstone; Sgt. F. W. B. Norris; Sgt. H. W. Stow; Sgt. A. Thomson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. W. D. Copland.

DIED ON ACTIVE SERVICE.—A/C.1 E. Aston; L.A/C. H. T. Burgess; L.A/C. L. J. Death; P/O. C. W. Forsyth; A/C.2 J. B. Gordon; A/C.2 W. Harrison; L.A/C. J. J. Hodgson; Sgt. E. L. Holmes; L.A/C. B. J. Pritchard; Cpl. L. A. Shore.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. N. Goodridge; F/O. A. C. Swan.

MISSING, BELIEVED KILLED IN ACTION.—F/O. E. A. Adams.

MISSING.—Flt. Sgt. A. B. Barrett; F/O. P. N. Birt; Flt. Sgt. J. Brady; Flt. Lt. F. L. Conn; P/O. R. S. Ebert; F/O. C. R. Fairburn; F/O. A. B. Fitzhardinge; W/O. J. Johnson; Flt. Sgt. R. J. Lyons; F/O. H. O. Mason; Flt. Sgt. D. G. O'Hara; F/O. R. K. Oliver; W/O. B. S. Smith; Flt. Sgt. W. A. Taylor; Flt. Sgt. S. G. Wilson; F/O. J. K. Wood.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. J. D. C. Bell.

KILLED ON ACTIVE SERVICE.—P/O. J. H. Crone; P/O. L. M. Riordan.

Air Chief Marshal Sir Sholto Douglas, K.C.B., M.C., D.F.C., decorating U.S. naval pilots with the D.F.C. during the ceremony of closing down Dunkeswell airfield in Devonshire.

(Left) Badge of No. 792, now No. 794, Naval Air Arm Squadron. (Motto not yet decided). On a white field, a lion rampant, red, holding between the forepaws a target proper. (Right) Badge of No. 793 Naval Air Arm Squadron. (Motto not yet decided). On a white field, a falcon rising holding in its talons a target pierced in the centre by two arrows, all proper.

(Left) Badge of No. 842 Naval Air Arm Squadron. (Motto not yet decided). Field, blue. Over water, barry wavy in base, white and blue, a winged anchor, white, suspended therefrom by a riband gold, a bugle horn also proper. (Right) Badge of No. 853 Naval Air Arm Squadron. "Defend, Avenge." On a blue field, a Greek warrior with spear, riding on a Pegasus all gold.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. D. H. Cumming; P/O. F. R. MacRovic.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. W. L. Alder; Sqn. Ldr. D. MacK. Arnot, D.F.C.; P/O. J. Bell; P/O. J. J. Blanchard; Flt. Sgt. J. C. Calhoun; Flt. Sgt. W. L. J. Clark; P/O. G. F. Clough; F/O. R. C. Collins; F/O. W. A. Cook; P/O. J. T. E. Cumming-Bart; P/O. R. A. Dumas; P/O. B. E. Galbraith; P/O. R. C. Gaudet; F/O. M. C. Grevstad; F/O. C. G. Hetherington; P/O. D. H. Jonasson; Ft. Lt. D. D. Lsidlaw; P/O. D. A. Laird; P/O J. A. Laviolette; F/O. D. A. MacGregor; P/O. J. D. McIntosh; F/O. A. C. McKenzie; F/O. K. B. Malcolm; P/O. I. W. Martin; F/O. A. H. Mildon; F/O. H. Moroz; P/O. B. H. Murdock; P/O. R. O. Nickerson; F/O. E. M. O'Donnell; P/O. J. F. O'Dowda; P/O. J. C. Owens; P/O. J. P. Papineau; P/O. J. A. N. Pare; F/O. T. W. Pearson; F/O. J. M. Ramsay; P/O. C. A. Ritchie; F/O. R. J. Roach; P/O. W. E. Rood; F/O. A. W. Shirley; P/O. W. F. Sutherland; P/O. J. A. Taylor; W/O. H. Thornton; F/O. A. L. Warren; P/O. H. L. Wootten; Sgt. R. Zimmer.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. H. Byers; F/O. P. H. Kearse; F/O. F. R. F. Skelly; F/O. I. J. V. Wallace.

MISSING.—F/O. G. I. Allan; W/O. C. D. Beck; P/O. J. E. Bohemier; F/O. W. T. Dunkeld; F/O. R. Edge; Flt. Sgt. G. R. Hamilton; F/O. G. G. Harrison; Flt. Lt. F. H. Richards; F/O. W. Russell; Flt. Lt. E. S. Smith; F/O. M. A. Smith; Sqn. Ldr. R. H. Stringer, D.F.C.; Flt. Lt. J. Waslyk; P/O. W. B. Whitmore.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—W/O. G. K. Jarvis.

DIED ON ACTIVE SERVICE.—L.A/C. J. E. R. Cloutier; Cpl. J. H. Cook; Cpl. C. R. Mason; F/O. J. O'Leary.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. G. Harrington; Flt. Lt. R. D. Lamb.

MISSING, BELIEVED KILLED IN ACTION.—F/O. H. J. Bennett.

MISSING.—Flt. Lt. H. E. Horsfall; Flt. Lt. L. R. Stuchbery; F/O. T. S. A. Tarrant.

South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—Lt. A. L. Spafford.

MISSING.—Lt. D. B. Dick; Lt. L. W. Douglass; Lt. W. E. Ellis; W/O. G. J. Geloenhuys; Lt. C. C. Schoombie.

Casualty Communique No. 517

Of the names in this list, 220 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. A. Barker, D.F.M.; Sgt. E. Baxter; Flt. Lt. P. D. W. Brunt; Flt. Sgt. L. Chapman, C.G.M.; W/O G. R. Coe; Sgt. M. Delahunty; Sgt. B. W. O. Dockerty; Flt. Sgt. S. Fleet; Sgt. T. A. Gibson; Sgt. A. Gray; F/O. A. E. Harris; Flt. Sgt. E. C. Hearn; F/O. J. N. Hickey; Sqn. Ldr. H. W. Horsley, A.F.C.; Sgt. P. R. Jefferies; Sgt. C. H. Jones; Sgt. A. C. Lloyd; Flt. Lt. B. S. Lyons; Flt. Sgt. V. D. Merrow; Sqn. Ldr. A. S. M. Pim, D.F.C.; W/O. H. J. Pyke; Flt. Sgt. A. A. Sheriff; Flt. Sgt. W. F. Taylor; Sgt. L. Tongue; F/O. G. A. Winter.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. S. Alldis; F/O. G. A. Baker; Sgt. P. Bowen-Chennell; Sgt. J. B. Carter; P/O. A. J. Clark; Sgt. H. J. Cossey; Sgt. A. C. Dalman; Flt. Lt. L. J. Greenhalgh; F/O. P. A. Ingrey; Sgt. R. M. Jordan; F/O. A. B. Leonard; Sgt. M. J. MacNaughton-Smith; Flt. Sgt L. J. Making; F/O. M. A. Monks; Sgt. A. J. Osbourn; P/O. F. J. Parkinson; Sgt. W. R. Parkinson; Sgt. I. M. Ross; Sgt. J. B. Ross; Sgt. J. H. Rudge; Flt. Sgt. M. B. Rumbles; Flt. Sgt. L. A. Ryan; Flt. Sgt. T. E. Sage; Flt. Sgt. R. H. Spencer; Flt. Sgt. D. G. Townsend; F/O. W. V Whittaker; Sgt. H. W. J. Yardley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. N. S. Allan; Flt. Sgt. G. R. Ansdell; Sgt. S. J. Arnold; W/O. W. Aspey, D.F.M.; F/O. A. F. Bayley; Flt. Lt. R. A. W. Beaumont; Sgt. E. E. Bebington; Sgt. D. B. Birbeck; F/O. P. C. R. Brown; Sgt. S. H. Bryant; Sgt. P. A. Budd; Sgt. R. E. Burt; Sgt. D. H. F. Burton; F/O. L. F. Clarke; Sgt. A. Cross; Sgt. D. V. Davies; Sgt. J. H. Donovan; Sqn. Ldr. L. H. Eno, D.S.O., D.F.C.; Sqn. Ldr. R. H. Fokes, D.F.C., D.F.M.; W/O. J. F. Forbes; Flt. Sgt. B. Fraser; Flt. Lt. D. H. H. Gathercole, D.F.C.; Flt. Sgt. H. F. Grianell; Sgt. E. Guinan; Sgt. N. Hannah; Sgt. W. E. Hardy; Sgt. G. Harrison; Sgt. G. A. Hays; Flt. Sgt. F. G. Hodgkins; Sgt. R. Hoole; F/O. G. Horsburgh, D.F.M.; Sgt. K. A. Horswell; Flt. Sgt. D. H. Jackson; F/O. R. Jacques; Sgt. M. Y. Z. Kalms; Flt. Sgt. J. G. W. Kelso; Sgt. J. K. Kimberley; W/O. D. R. Knowles; F/O. J. J. Knowles; F/O. L. I. Land; Flt. Sgt. R. G. Law; P/O. D. J. McCrudden; Flt. Sgt. T. C. McEneaney; W/O. D. McGrevy, D.F.M.; P/O. J. C. McLeish; P/O. S. McNabney; Flt. Lt. J. L. Martin; Sgt. H. L. Molyneux; W/O. G. A. Mould, Sgt. D. G. Mumford, Sgt. R. Pead, Flt. Sgt. D. J. E. Poole; Flt. Sgt. J. H. Pownall; Flt. Sgt. A. E. Roberts; Sgt. H. Rothwell; Flt. Sgt. A. Sharpe; Sgt. A. Smith; Sgt. F. E. A. Smith; Flt. Lt. L. W. G. Ward; P/O. T. W. Waugh; Sgt. W. D. Webster; W/O. A. H. Wetone; Sgt. T. J. Whiteside; F/O. N. B. Wilcock; Sgt. J. G. Wise; Sgt. E. S. Worden.

WOUNDED OR INJURED IN ACTION.—Sgt. K. G. I. De La Mare; Sgt. R. T. Hoskinson.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. R. C. Fenner.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. K. V. Dennis; Sgt. P. M. Holt; Sgt. W. McCabrey.

MISSING.—Sgt. R. Breaks; F/O. R. N. Brown, D.F.M.; F/O. C. P. Clark; F/O. E. Clarke; Flt. Sgt. A. S. Crystal; Sgt. G. Gittins; P/O. M. D. Groundwater; Sgt. R. W. Gullick; F/O. N. P. Hibbert; W/O. J. V. Higgins; Flt. Sgt. J. H. Holt; Flt. Sgt. D. G. Jones; Sgt. F. J. Keeble-Buckle; Flt. Sgt. H. J. Knightsbridge; Flt. Lt. H. Y. Lao; Sgt. G. Lester; Flt. Lt. J. K. Livingstone, D.F.C.; Sgt. L. Middleton; F/O. H. J. O'Connor; W/O. F. Parr, D.F.M.; F/O. E. G. A. M. Beatty; F/O. R. A. Booth; F/O. T. A. MacK. Christie; P/O. N. H. Clifford; P/O. G. J. T. Dunlop; F/O. A. C. Elliott; P/O. E. D. Empey; P/O. S. S. Finlayson; P/O. L. A. Foster; P/O. V. A. Goodwin; F/O. K. B. Hadley; P/O. J. Handzuk; W/O. A. A. Jepson; P/O. D. S. Kirkwood; P/O. L. M. Meyer; P/O. S. M. Naugler; Sgt. C. E. Scott; Flt. Sgt. R. N. Simpson; F/O. H. W. Smith; P/O. L. Spensley; F/O. E. A. T. Taylor, D.F.C.; F/O. R. E. Warren; Sgt. D. M. Willmott.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. L. A. Allen; Flt. Sgt. A. A. Anderson; F/O. D. H. Bailey; Flt. Sgt. R. L. Bars; Flt. Lt. L. T. Berrigan; F/O. J. D. Brown; P/O. W. J. R. Charles; F/O. A. C. Colville; F/O. R. D. Crone; P/O. F. Davenport; F/O. P. Dowd; F/O. G. H. Durston; P/O. E. S. Dwyer; F/O. L. B. Fincham; F/O. W. R. Finlayson; P/O. C. C. Flewelling; P/O. G. F. Freeman; F/O. D. E. Geldart; P/O. C. A. Griffiths; F/O. J. A. F. Heffernan; F/O. R. A. Irwin; F/O. J. T. Isfan; P/O. N. Johnston; P/O. S. K. Kaiser; F/O. L. S. Kennedy; F/O. R. S. Knapp; Sqn. Ldr. H. L. Lindo, D.F.C.; P/O. S. G. Livingstone; F/O. J. C. Lummis; P/O. L. A. McCrea; P/O. R. E. McGregor; F/O. P. A. McLachlan; P/O. D. K. MacLeod; F/O. W. W. Mitchell; P/O. A. R. Moorby; F/O. J. L. Moore; P/O. N. E. Moore; F/O. C. G. Neville; P/O. D. J. O'Brien; P/O. J. C. O'Connell; F/O. R. E. O'Heare; Flt. Lt. D. Ramsay, D.F.C.; P/O. J. G. M. Renaud; P/O. C. W. Rose; F/O. M. A. Siddons; Sgt. E. Smith; P/O. C. C. V. D. Spencer; Flt. Sgt. S. D. Spencer; F/O. R. J. Tomlinson; P/O. T. D. Turner; Sgt. W. E. Vancoughnett;

Air Chief Marshal Sir Arthur Tedder, Deputy Supreme Commander, being greeted on his arrival at Bromma airport, Stockholm. Sir Arthur was accompanied by his wife

Royal Australian Air Force

KILLED IN ACTION.—P/O. E. A. Bogan; P/O. B. I. H. Hicks; P/O. N. H. Sisley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. H. L. Barron; F/O. J. R. Fry; Flt. Sgt. R. T. Hill; P/O. A. F. Roche; Flt. Sgt. M. T. Whittenbury.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. T. F. Beecher; Flt. Sgt. V. E. Cockroft; F/O. D. P. Croston; W/O. C. C. Jones; F/O. L. Kidd; Flt. Sgt. W. D. D. Killworth; Flt. Sgt. L. H. Porritt; Sqn. Ldr. M. Powell, D.F.C.; P/O. P. W. Ryan; Flt. Sgt. J. P. Steffan; F/O. W. J. Woods.

MISSING.—P/O. R. O. Bailey; F/O. S. H. Bignell; F/O. J. Costigan; Flt. Sgt. J. W. Lacey; P/O. G. C. McKenna; Flt. Sgt. C. A. G. Russell; Flt. Sgt. T. M. Thoroughgood; Flt. Sgt. W. A. Wilkie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. R. L. Giles.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. R. E. Chatfield; W/O. G. J. Doyle; F/O. W. Fleming; W/O. R. J. Nicolls; Flt. Lt. R. M. Trites; Wing Cdr. E. M. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. A. Allan; P/O. W. Baxter; F/O. A. M. Beatty; F/O. R. A. Booth; F/O. T. A. MacK. Christie; P/O. N. H. Clifford; P/O. G. J. T. Dunlop; F/O. A. C. Elliott; P/O. E. D. Empey; P/O. S. S. Finlayson; P/O. L. A. Foster; P/O. V. A. Goodwin; F/O. K. B. Hadley; P/O. J. Handzuk; W/O. A. A. Jepson; P/O. D. S. Kirkwood; P/O. L. M. Meyer; P/O. S. M. Naugler; Sgt. C. E. Scott; Flt. Sgt. R. N. Simpson; F/O. H. W. Smith; P/O. L. Spensley; F/O. E. A. T. Taylor, D.F.C.; F/O. R. E. Warren; Sgt. D. M. Willmott.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. L. A. Allen; Flt. Sgt. A. A. Anderson; F/O. D. H. Bailey; Flt. Sgt. R. L. Bars; Flt. Lt. L. T. Berrigan; F/O. J. D. Brown; P/O. W. J. R. Charles; F/O. A. C. Colville; F/O. R. D. Crone; P/O. F. Davenport; F/O. P. Dowd; F/O. G. H. Durston; P/O. E. S. Dwyer; F/O. L. B. Fincham; F/O. W. R. Finlayson; P/O. C. C. Flewelling; P/O. G. F. Freeman; F/O. D. E. Geldart; P/O. C. A. Griffiths; F/O. J. A. F. Heffernan; F/O. R. A. Irwin; F/O. J. T. Isfan; P/O. N. Johnston; P/O. S. K. Kaiser; F/O. L. S. Kennedy; F/O. R. S. Knapp; Sqn. Ldr. H. L. Lindo, D.F.C.; P/O. S. G. Livingstone; F/O. J. C. Lummis; P/O. L. A. McCrea; P/O. R. E. McGregor; F/O. P. A. McLachlan; P/O. D. K. MacLeod; F/O. W. W. Mitchell; P/O. A. R. Moorby; F/O. J. L. Moore; P/O. N. E. Moore; F/O. C. G. Neville; P/O. D. J. O'Brien; P/O. J. C. O'Connell; F/O. R. E. O'Heare; Flt. Lt. D. Ramsay, D.F.C.; P/O. J. G. M. Renaud; P/O. C. W. Rose; F/O. M. A. Siddons; Sgt. E. Smith; P/O. C. C. V. D. Spencer; Flt. Sgt. S. D. Spencer; F/O. R. J. Tomlinson; P/O. T. D. Turner; Sgt. W. E. Vancoughnett;

Women's Auxiliary Air Force

KILLED ON ACTIVE SERVICE.—A/CW.1 J. R. Barrett.

SERVICE AVIATION

P/O. W. G. Wakely; F/O. O. Wright; P/O. J. J. Yelland; P/O. L. E. Yeo; F/O. H. K. Young.

WOUNDED OR INJURED IN ACTION.—F/O. J. E. H. B. Tremblay.

MISSING BELIEVED KILLED IN ACTION.—Flt. Sgt. J. MacC. Rae; Flt. Sgt. G. A. Smith.

MISSING.—F/O. J. W. Blades; F/O. F. H. Cummer; Flt. Lt. J. H. Freeman; Flt. Sgt. F. L. Jolicoeur; Flt. Sgt. J. F. Kaviza; Sqn. Ldr. H. L. Kay; F/O. G. J. Liney; Flt. Sgt. E. F. Ossington; Flt. Sgt. E. R. Savage; F/O. W. B. Turner; F/O. D. Watson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. I. L. Johns.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. R. F. Easen.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. B. W. Matheson.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. T. W. Boyce; P/O. I. E. Blance; Flt. Sgt. F. W. Climo.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. A. Crozier; Flt. Lt. R. N. Johnstone; W/O. L. H. Lissette.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. F. Hardman.

MISSING.—Flt. Sgt. S. E. Sadler; P/O. E. C. Temperton.

South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—Lt. J. Lithgow.

MISSING.—Lt. G. L. Redman.

Casualty Communiqué No. 518

Of the names in this list, 205 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Wing Cdr. W. G. Bannister; Sgt. A. J. Boyles; Sgt. J. J. Chidwick; Wing Cdr. I. G. E. Dale, D.F.C.; F/O. G. R. P. Duncan; F/O. K. A. Hackett; Sgt. H. J. Hutchinson; W/O. W. J. Luffman; Sgt. D. F. Luxford; Flt. Lt. G. L. S. McHardy, D.F.C.; Sgt. A. Moore; Sgt. R. Swan; Sgt. F. E. Turner; Sgt. G. L. Webb; Sgt. R. R. Wiggins; Flt. Lt. H. A. W. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. K. G. Bellingham; Flt. Sgt. P. F. Bishop; Sgt. J. W. Blanchard; Sgt. J. Cuffey; Flt. Sgt. T. G. Franklin; F/O. K. D. Goddard; Flt. Sgt. A. Laverick; Sgt. P. W. Leach; Sgt. S. J. Malaband; Sgt. J. Moffat; Sgt. D. F. A. Peach; F/O S. Solomon; Sgt. J. Thompson; F/O. J. Turner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. B. C. Acourt; F/O. C. R. Allen; Sgt. K. R. Ansell; W/O. R. F. Badman; Sgt. R. F. Banks; Sgt. L. H. J. Barr; Sgt. J. E. Bates; F/O. A. J. Baythorp; Sgt. J. E. Beeson; F/O. P. A. C. Bell; F/O. J. J. Berg; Sgt. P. E. Bethell; Sqn. Ldr. K. G. Bickers, D.F.C.; Sgt. D. B. Bloomfield; P/O. J. H. Bolton; Sgt. J. Brooke; Sgt. D. J. Brotherton; F/O. J. G. Bryson; Flt. Sgt. F. W. Bull; F/O. J. J. K. Burr; Sgt. F. T. Cadge; Flt. Sgt. D. Cannon; P/O. L. Cannon; Sgt. T. D. Cant; Sgt. H. Clarke; Sgt. R. Clewer; F/O. E. C. Colcomb; Flt. Sgt. T. P. Collins; Flt. Sgt. L. J. Comer; Sgt. G. Crabb; Sgt. W. Craig; Flt. Sgt. D. Curtis; Flt. Sgt. F. Dadd; Sgt. H. Daggett; Sgt. K. H. Dean; Sgt. R. G. Dennett; W/O. J. E. R. Ede; W/O. E. C. Ells; Sgt. D. Evans; Sgt. F. Eyres; Flt. Sgt. J. H. D. Fenwick; Sgt. A. Y. Ferguson; Sgt. D. M. Ford; Sgt. G. H. Foreman; Flt. Sgt. D. P. J. Froud; Sgt. J. Gill; Flt. Sgt. R. L. Givens; Sgt. B. Glover; F/O. C. S. Goble; Sgt. A. Goodacre; Sgt. N. J. Goss; Sgt. W. J. Green; Sgt. A. C. Griffiths; Sgt. E. R. Hall; Sgt. W. A. Hammond; Sgt. R. T. Harper; Sgt. E. C. E. Harris; Flt. Sgt. F. C. Harvey; F/O. D. W. C. Hawken; Sgt. W. F. Hearn; F/O. J. W. Henry; F/O. J. N. Hinton; Sgt. H. H. Howles; Sgt. R. J. Hughes; Flt Sgt. G. J. Hull; Flt. Sgt. D. J. Kilner; P/O. A. Kularine; Sgt. J. J. Lambert; Sgt. W. Lee; Sgt. N. Lishman; Sgt. C. W. Lloyd; F/O. P. A. Lockton; Sqn. Ldr. A. J. Loughborough; Sgt. C. Lowrie; Flt. Sgt. G. M. Lucas; Sgt. H. L. Madden; Sgt. N. Max; Sgt. S. J. Mead; Sgt. R. A. Messenger; F/O. E. R. Mills; Sgt. R. J. Mottram; Sgt. R. Nash; P/O. P. E. N. Nice; P/O P. R. Noyes; Sgt. P. L. O'Brien; Sgt. A. G. Owen; Sgt. T. Y. Owen; Sgt. K. E. Peake; Flt. Sgt. H. Perkins; F/O. C. J. Plummer, D.F.C.; Sgt. C. F. Poole; Sgt. J. R. Powell; Flt. Sgt. G. F. Pridham; F/O. L. Pulfrey; Sqn. Ldr. J. L. Ramson; P/O. W. G. Ramwell; Sgt. G. A. Ritchie; Sgt. E. G. Sears; Sgt. C. J. Selby; Sqn. Ldr. D. A. Sewell; F/O. H. K. Sneasby; Sgt. H. Sherliker; P/O. T. M. J. Shervington; Sgt. A. Small; Sqn. Ldr. G. S. Smith, D.F.C.; P/O. L. J. R. Smith; Flt. Sgt. R. C. Smith; Sgt. H. D Steele; Sgt. R. Stones; P/O. C. E. R. Tanner; Sgt. F. J. Taylor; F/O. V. N. Taylor; Sgt. W. Taylor; Sgt. O. A. Teasdale; Sgt. W. E. Thurnall; Flt. Lt. St. J. Tizard; F/O. N. Tombs; Flt. Sgt. R Townsend, D.F.M.; Flt. Sgt. D. J. Tucker; Sgt A. C. Twitchett; Flt. Sgt. A. V. Verdon; Sgt J. E. Walsh; Flt. Lt. W. D. St. C. Weeks; Sgt. R. West; Sgt. W. R. Wharmby; Sgt. L. P. Whelan; Flt. Sgt. D. White; Sgt. H. Wyrill.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Wing Cdr. G. P. Gibson, V.C., D.S.O., D.F.C.; Flt. Sgt. J. Milne; Sqn. Ldr. J. B. Warwick, D.F.C.

WOUNDED OR INJURED IN ACTION.—Sgt. K. Hudspeth; F/O. R. E. Mooney.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. H. C. Locke.

MISSING.—Sqn. Ldr. P. A. Bates, D.F.C.; F/O. W. G. Cadman, D.F.C.; Flt. Lt. J. D. Callaghan; Sgt. T. H. Chandler; Flt. Lt. H. B. Clarke; Sgt. F. Cowell; Sqn. Ldr. D. R. Crawford; Sgt. E. H. Fletcher; Sqn. Ldr. J. Garden, D.F.C.; Flt. Sgt. W. R. Gregory; Flt. Lt. R. P. Harding; W/O. A. W. Hearndon; F/O. H. H. Hopkin; P/O. E. S. Leach; Flt. Sgt. L. Maguire; P/O. W. J. Patterson; Flt. Lt. F. W. Price; Sgt. J. A. Quick; P/O. F. V. Robinson; Flt. Lt. J. D. Ross; F/O. W. C. D. Slater; Sgt. J. Stevenson; Flt. Sgt. N. Wagstaffe, Sgt. J. Ward, F/O. D. Washer; F/O. W. F. Younger.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—P/O. C. D. Callum; Sgt. P. B. Kellegher; F/O. H. S. J. King; Sgt. C. Woodhead.

KILLED ON ACTIVE SERVICE.—Sqn. Ldr. A. E. Alderton; F/O. F. Bishop; Flt. Sgt. W. D. Browe; Sgt. C. B. Darby; F/O. W. M. Earl; F/O. H. Ellis; Sgt. J. M. Finch; W/O. G. H. French; Flt. Lt. G. A. Liversidge; Sgt. H. Metzger; Sgt. P. H. Morris; F/O. J. K. Pridmore; Flt. Lt. A. G. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. A. J. M. F. Bailey; Sgt. E. Glayden; Sgt. C. B. Norman; Sgt. A. Orrick.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sgt. V. Wadmore.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. T. B. M. Alexander; L.A/C. D. F. Barker; L.A/C. C. McC. Bennett; L.A/C. W. L. Bowling; L.A/C. B. K. Buckley; L.A/C. M. C. Burden; L.A/C. J. F. Butterfield; L.A/C. R. A. F. Clark; L.A/C. C. H. Collin; L.A/C. N. Croft; L.A/C. J. W. Dobson; Flt. Lt. J. D. L. Gammie; L.A/C. G. A. Ginn; L.A/C. J. Greenhalgh; Sgt. D. Holloway; Cpl W. D. James; L.A/C. H. A. Jinks; Flt. Lt. B. Miller; Sgt. R. G. Morrison; A/C.1 N. W. Swift; L.A/C. J. Whitley.

DIED ON ACTIVE SERVICE.—L.A/C. R. Barnes; L.A/C. A. Blake; Sgt. D. W. Evans; P/O. J. S. Hill; Cpl. W. Naylor; L.A/C. F. E. Nightingale; L.A/C. J. O'Neill; L.A/C. T. J. Suffield; L.A/C. D. A. Wall; Flt. Sgt. J. S. Wallace; L.A/C. W. E. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Lt. T. R. Jenkins.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. R. J. Andrews; Flt. Sgt. P. M. Hore; P/O. O. Mountford, D.F.C.; P/O. E. G. Wicky, D.F.C.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. W. C. Chandler; Flt. Sgt. W. M. Christie; Flt. Sgt. H. Gavin; F/O. W. D. McKay; P/O. O. K. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. J. Downie; Flt. Sgt. T. L. Roberts.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. A. R. Emerton; Flt. Lt. R. W. S. Gross; Flt. Lt. S. R. H. Reeve; Flt. Sgt. W. N. Watts.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. H. T. Groennou.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. D. W. D. Guest.

MISSING.—F/O. P. G. Cameron; W/O. S. E. Richards.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. B. L. Conolan; W/O. M. T. Lee; W/O. K. H. Watts.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. W. G. Brady; Flt. Sgt. W. J. Fox; W/O. W. D. G. Frost; Flt. Sgt. C. F. Marshall.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. T. A. Malcolm.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. J. A. Keating; P/O. R. A. Playter; W/O. J. Train.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. E. J. Andrews; Sqn. Ldr. G. S. Beall; F/O. D. G. Bentley; P/O. R. F. Christie; F/O. D. Hughes; F/O. J. F. Robinson; P/O. W. C. Stainton; P/O. W. McG. Stewart; F/O. C. Szymanski; P/O. D. E. Tate; P/O. C. G. Wenzel.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sqn. Ldr. G. Bennett, D.F.C.; P/O. G. N. Bennett; F/O. J. A. C. Brown; W/O. D. E. Derbyshire; F/O. R. E. Durnford; P/O. S. F. Ellis; F/O. R. H. Forster; W/O. R. L. Francis; F/O. H. Freeman; P/O. I. L. E. Gould; P/O. W. L. Granbois; P/O. A. Hamilton; P/O. E. C. Howey; Flt. Sgt. J. P. Keenan; P/O. E. D. Kent; P/O. D. C. Lewthwaite; F/O. H. H. MacKenzie; P/O. J. A. Moffat; Sgt. H. C. Oswald; Sgt. H. T. Peebles; Flt. Lt. D. H. Perry; F/O. S. G. Peterson; W/O. L. H. Rogers; P/O. G. E. Sinclair; F/O. J. E. Stewart; F/O. T. W. Thompson; P/O. J. S. Thomson; P/O. J. Wilson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. G. Dean.

MISSING.—F/O. N. G. Baily; Flt. Lt. G. J. Bruce; F/O. D. L. Dewart; Flt. Sgt. F. Henry; Flt. Sgt. B. E. House; F/O. W. M. Howard; P/O. C. L. Johnston; P/O. J. C. Mortley; F/O. J. A. O'Brien; Sgt. G. D. O'Connor; F/O. D. A. Spice; Sgt. E. A. Wilson.

KILLED ON ACTIVE SERVICE.—P/O. H. L. Clark; Flt. Sgt. S. Filipchuk; P/O. N. L. Gordon; Sgt. J. W. Ross.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. J. H. Carter.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. B. Grabb.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Lt. L. MacD. Anderson.

Royal New Zealand Air Force

MISSING.—F/O. J. L. Gutzewitz; W/O. E. W. McPherson.

South African Air Force

KILLED IN ACTION.—Lt. W. M. Allison; Lt. J. H. Buxmann.

MISSING, BELIEVED KILLED IN ACTION.—Lt. M. B. Hall.

MISSING.—Lt. P. J. B. Kruger.

KILLED ON ACTIVE SERVICE.—Lt. H. D. Ashurst; Lt. H. Beel; Flt. Sgt. W. J. T. Carstens; Lt. L. P. Dittberner; Flt. Sgt. H. N. Kerruish; Lt. L. V. Lambert; Flt. Lt. D. G. McClead; Lt. R. K. Morse.

Air Transport Auxiliary

First Off. R. J. R. Jackson, missing from a ferry flight, May 23rd, 1945.

Official Corrections

Casualty List No. 509.

Under MISSING, delete Flt. Sgt. J. A. R. Bertlin, Sgt. D. B. M. Hodges, Flt. Sgt. T. M. Laurie, Sgt. A. L. Smith, F/O. A. Tittle, P/O. E. A. Wass and Sgt. P. Stimpson.

Under KILLED ON ACTIVE SERVICE, insert Flt. Sgt. J. A. R. Bertlin, Sgt. P. Stimpson, Sgt. L. R. Woods.

Delete heading PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR, and all names.

Delete R.A.A.F. heading PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR, and all names.

Under R.C.A.F., MISSING, delete P/O. J. T. R. Caughy, F/O. A. L. Coldwell.

Delete R.C.A.F. heading PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR, and all names.

Casualty List No. 510.

Under PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION, Sgt. C. McLean change to McClean.

Under MISSING, delete Sgt. E. J. Burke, F/O. J. Norton.

Delete all under PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR (from Flt. Sgt. L. P. Barham to Flt. Sgt. L. Wesley inclusive).

Delete R.A.A.F., MISSING, Flt. Lt. A. W. D. McLachlan.

Under PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR, delete F/O. K. A. Howard, Flt. Sgt. R. W. Perry.

Under R.C.A.F., KILLED IN ACTION, change P/O. J. R. Wilson; should read .F/O J. R.

Delete R.C.A.F., MISSING, Flt. Sgt. D. C. Cockwill, Flt. Lt. D. S. Nelson, Flt. Sgt. F. W. Dobbs change to P/O. F. W., Flt. Sgt. J. S. Netzke change to P/O. J. S., Flt. Sgt. A. M. O. Walker change to P/O. A. M. O.

Delete 12 PRISONERS OF WAR: P/O. H. Atkin, W/O. D. Clark, W/O. S. A. E. Compton, Flt. Sgt. F. H. Fulsher, F/O. J. D. Harvie, F/O. S. G. Hetherington, P/O. D. High, F/O. T. R. Hodgson, Flt. Lt. C. R. Hoffman, F/O. P. Scullion, P/O. J. Sonshine, F/O. E. C. Watson.

Delete PRISONERS (R.N.Z.A.F.): F/O. M. F. Cullen, Sqn. Ldr. P. J. Lamason.

Under S.A.A.F., MISSING, BELIEVED KILLED IN ACTION, 2nd Lt. C. B. Susskind should be inserted under KILLED IN ACTION.

Delete PRISONER OF WAR, W/O M. Zerff.

Casualty List No. 513.

Under MISSING, BELIEVED KILLED IN ACTION, Sgt. G. C. Telfer should read Flt. Sgt. G. C.

Under MISSING, delete Sgt. R. A. Boydell, W/O. J. F. Carberry, Flt. Sgt. J. D. Rowbottom, Flt. Sgt. N. J. Stebbings, Sgt. R. H. V. Streatfield, Flt. Lt. W. H. Wilson.

Under PREVIOUSLY REPORTED MISSING, delete Sgt. W. Hazen.

Under PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONERS OF WAR, delete Flt. Sgt. A. J. Chinn, Flt. Sgt. J. Clarke, Sgt. P. Dowdeswell, F/O. L. Williams.

R.A.A.F.

Under WOUNDED OR INJURED ON ACTIVE SERVICE, delete W/O. S. J. Sandilands.

R.C.A.F.

Under MISSING, delete P/O R. R. Broadfoot, Flt. Sgt. S. Camerman, Flt. Sgt. H. J. A. Cote, W/O. R. A. Deck, F/O. D. W. Gaunt, Flt. Sgt. A. M. Lacchia, P/O. T. E. Lynch, Flt. Sgt. B. W. McNicol, Sgt. F. W. Poole. Flt. Sgt. S. G. Rundle to read P/O.

Casualty List No. 514.

Under MISSING, delete P/O. D. Blair, P/O. A. O. Blencowe, F/O. P. Cook.

Transfer F/O. G. E. Locke to KILLED IN ACTION.

R.A.A.F.

Under PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION, Flt. Sgt. A. F. Moore to read P/O.

Under MISSING, delete F/O. H. T. McGovern, Flt. Sgt. T. P. Quinn to read P/O. Flt. Sgt. R. L. Stewart to read P/O.

Under KILLED ON ACTIVE SERVICE, Flt. Sgt. R. B. Rathbone to read W/O.

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Flt. Sgt.